Research Product 85-11

Unit Fire Direction Center Training Program for the 81MM Mortar

ARI Field Unit at Fort Benning, Georgia
Training Research Laboratory

February 1985

U. S. Army Research Institute for the Behavioral and Social Sciences

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This Research Product presents a Fire Direction Center (FDC) training program for units. It was designed for an FDC section chief to use in training fire direction computers in all aspects of FDC operations. Instruction is situationally focused on the preparation of observed, modified observed, and surveyed firing charts with the M16 plotting board. The use of these firing charts in both basic and advanced missions is covered. Detailed lesson outlines, performance examinations, and supporting training materials are included. Keywords:

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Education and Training

FOREWORD

Throughout its history the mortar has been a critical support weapon for the infantry. Its use has enabled heavier fire to be placed upon enemy targets than that afforded by traditional small arms alone. However, mortar training in the U.S. Army presently suffers from resource restrictions, making it essential to identify the most efficient and effective training procedures possible. In support of the U.S. Army Infantry School, the U.S. Army Research Institute conducted a training effectiveness analysis of institutional and unit mortar training. One major problem identified in this analysis was the need for an exportable Fire Direction Center (FDC) training course for units. Thus, the present research product was developed to provide a unit FDC training program for the 81mm mortar.

EDGAR M. JOHNSON
Technical Director

UNIT FIRE DIRECTION CENTER TRAINING PROGRAM
FOR THE 81MM MORTAR

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UNIT FIRE DIRECTION CENTER TRAINING PROGRAM FOR THE 81MM MORTAR

INTRODUCTION

Throughout its history the mortar has been a critical support weapon for the infantry. Its use has enabled heavier fire to be placed upon enemy targets than that afforded solely by traditional small arms. However, mortar training in the U.S. Army presently suffers from resource restrictions, making it essential to identify the most efficient and effective training procedures possible. Accordingly, the U.S. Army Infantry School (USAIS) has initiated research to improve the training effectiveness of mortar courses, procedures, and training materials. In support of the USAIS, the Fort Benning Field Unit of the U.S. Army Research Institute (ARI) conducted a mortar training effectiveness analysis to identify both short and long range possible improvements.[1]

A major finding of this training effectiveness analysis was that unit training in Fire Direction Center (FDC) procedures needs to be improved. The FDC component of the indirect fire team is concerned with the task of converting calls for fire into proper fire commands, that when applied to the guns, will help insure the timely delivery of accurate mortar fire. It appeared from this analysis that the greatest variability in a unit's ability to deliver mortar fires is largely related to the performance of its FDC personnel. Further, institutional training for FDC computing tasks, most of which are Skill Level 2 tasks, is generally unavailable to most FDC computers

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[1] Fusha, J. E., Renn, A. N., & Thompson, T. J. (1984). Training effectiveness analysis: Status of institutional and unit mortar training (ARI Research Report 1367). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

(grades E-4 or E-5). The first opportunity for institutional mortar training is the Basic Non-Commissioned Officer Course (BNCOC), designed to develop a section leader competent in critical Skill Level 3 tasks. Due to an apparent lack or ineffectiveness of unit FDC training, BNCOC instructors have been required to place greater emphasis on the prerequisite Skill Level 2 tasks. As a result of this training effectiveness analysis, it was recommended that an exportable training course be designed and implemented to insure that the necessary Skill Level 2 FDC expertise could be developed at the unit level.

DEVELOPMENT OF A UNIT 81MM MORTAR FDC TRAINING PROGRAM

All USAIS institutional training programs that include instruction in Skill Level 2 mortar tasks were reviewed as a basis for the development of a unit FDC training program for the 81mm mortar. Programs included in this review were BNCOC, the Advanced Non-Commissioned Officer Course (ANCOC), and the Infantry Mortar Platoon Course (IMPC). Due to its comprehensiveness and high level of instructional quality, the FDC portion of IMPC and ANCOC was selected as the model for the design of the unit program. The FDC portion of IMPC and ANCOC is taught by the FDC Branch of the Mortar Division of the Weapons, Gunnery, and Maintenance Department (WGMD) of USAIS. Their FDC training program for the 81mm mortar contains two segments. Basic tasks are taught in FDC Procedures I, while advanced tasks are taught in FDC Procedures II.

During FDC Procedures I, instruction is presented on the use of the M16 plotting board as either an observed, modified observed, or surveyed firing chart, based upon the type of target information in the call for fire. Students also learn to record ballistic meteorological (MET) messages, determine and apply MET and registration corrections, and develop appropriate range safety data. Instruction is presented situationally, in that students are required to manipulate the plotting board and to use associated equipment. Training periods are reinforced with team drills in which students perform techniques and procedures taught previously. During team drill exercises, students are allowed to work together and instructors are available to provide needed assistance. Following FDC Procedures I, a performance examination is administered.

During FDC Procedures II, instruction is presented on the computation of firing data for area targets, illumination missions, split section operations, final protective fires, and smoke missions. The instructional format parallels that in FDC Procedures I, with students conducting step-by-step plotting board manipulation under the direction of instructor personnel. Reinforcement training is accomplished through the use of team drills. Following a live-fire exercise, a performance examination is administered.

The unit FDC training program for the 81mm mortar was developed jointly with the Mortar Division of WGMD. Their institutional FDC training program for the 81mm mortar was reorganized to provide a greater degree of standardization from class to class and from instructor to instructor. In conjunction with this instructional reorganization, the exportable unit training package was developed. Although highly similar to the institutional program in terms of course content, the unit program was designed for an FDC section chief to use in training his FDC computers in all aspects of FDC operations. Detailed lesson outlines were written for the unit program that include discussion questions, specific examples of computing problems, and supporting visual training aids. Covering all basic FDC tasks, the lesson outline of Fire Direction Center Procedures I is contained in Appendix A. The lesson outline of Fire Direction Center Procedures II, covering advanced FDC tasks, is contained in Appendix B. Paper copies of the supporting vu-graphs for both lessons are contained in Appendix C.

In order to evaluate the performance of unit FDC computers, examinations have been included in the package that can be administered following FDC Procedures I (see Appendix D) and FDC Procedures II (see Appendix E). In

addition, a "Notes to Trainers" section was written to introduce unit instructors to the program and to guide them in its implementation (see Appendix F). This section discusses the purpose, scope, and conduct of training. While the entire program includes 44 hours of instruction, training can be conducted on a task-by-task basis as a unit's training schedule permits. Training materials required for instruction are also listed, as are a wide variety of existing materials that can be used for reinforcement training.

PROGRAM UTILIZATION

The unit FDC training program for the 81mm mortar incorporates approved institutional training objectives and standards of the USAIS (as proponent). While the institutional version of the FDC program was implemented within IMPC and ANCOC in January of 1984, the unit version has been submitted to the USAIS for approval. If adopted, with subsequent distribution to Infantry units Army-wide, it is expected that two primary benefits will accrue as a result of program utilization. First, it should drastically reduce the amount of time needed by unit trainers for lesson planning and preparation. And secondly, it should increase the level of standardization in FDC training across units.

APPENDIX A

FIRE DIRECTION CENTER PROCEDURES I: LESSON OUTLINE

I. INSTRUCTIONAL INTENT: Most soldiers have completed mechanical (gunnery) training and forward observer (FO) instruction. This is the first of two blocks of instruction in Fire Direction Center (FDC) procedures for the 81mm mortar. Soldiers will receive instruction and practical exercises in basic 81mm mortar fire direction control. It will be followed by instruction in advanced 81mm mortar FDC procedures. The training objectives of each block of instruction will be tested prior to additional instruction.

II. TRAINING OBJECTIVES: As a result of this instruction, the student must accomplish the following training objectives:

A. TASK: Inventory FDC equipment used as the primary means to control the fires of the 81mm mortar.

CONDITION: Given a computer's record, firing data sheet, and FDC equipment which may or may not be complete.

STANDARD: Identify all components of the 81mm mortar FDC equipment, and specify missing items, if any. (IAW Chp 15, FM 23-91)

B. TASK: Compute data on observed firing chart.

CONDITION: Given an M16 plotting board, a call-for-fire, a computer's record, a tabular firing table, subsequent FO corrections, map of area, protractor, and data sheet.

STANDARD: Prepare the M16 plotting board as an observed firing chart, record, and analyze the call-for-fire; fill out the FDC order; complete the heading information on the computer's record; record the initial fire commands; process subsequent corrections; determine deflection to nearest one mil and range to nearest 25 m; select the correct charge and elevation; and conduct fire missions using grid, shift, and polar methods of target location. (IAW Chp 15, FM 23-91)

C. TASK: Compute firing data using the M16 plotting board as a modified observed firing chart.

CONDITION: Given either the mortar location or target location within 10 m; an M16 plotting board; a map with situation overlay; a computer's record, data sheet, and tabular fire table.

STANDARD: Plot the known location to the nearest 10 m and transfer firing data from the observed firing chart; determine deflection to the nearest 10 mils and range to the nearest 25 m; select the correct charge and elevation; update data sheet and conduct fire missions using grid, shift, and polar methods of target location. (IAW Chp 15, FM 23-91)

D. TASK: Perform the duties of safety officer in conjunction with the FDC.

CONDITION: Given the right and left limit azimuth; maximum and minimum ranges; charges and ammunition which may be fired; an 8-digit grid coordinate for a mortar position; a range safety diagram; a mounting azimuth; and a referred deflection.

STANDARD: The right and left limit deflections will be determined within 0 mil, the charge and elevation combinations for maximum ranges must be recorded without error and the margin data must be recorded on the range safety diagram IAW FM 23-91.

E. TASK: Prepare a surveyed firing chart.

CONDITION: Given an M16 plotting board, a surveyed mortar location, and a surveyed target location.

STANDARD: Place a coordinate system on the M16 board, plot the mortar and target locations to the nearest 10 m, compute the mortar target azimuth to the nearest 1 mil. (IAW Chp 15, FM 23-21)

F. TASK: Compute a registration mission.

CONDITION: Given a computer's record, firing tables, M16 plotting board, and the decision to register and parallel the sheaf.

STANDARD: Compute initial and subsequent firing data and determine firing data corrections (if any) for paralleling the sheaf IAW Chp 15, FM 23-91.

G. TASK: Determine data from a re-registration and apply corrections.

CONDITIONS: Given a registration point and a directive to re-register and to determine the corrections to apply, FDC equipment, and firing data sheet.

STANDARD: Determine firing data for re-registration and apply corrections. Determine deflection to nearest one mil, range to the nearest 25 m, IAW Chp 13, FM 23-91.

H. TASK: Perform the integrated function of a FDC computer in determining and applying meteorological corrections.

CONDITION: Given two messages, DA Forms 2601-1 and 3675, registration point, M16 plotting board, location of the mortars and target, and FT 81-AI-3.

STANDARD: Compute the deflection corrections within one mil and the range corrections within one meter. Apply the corrections without error. (IAW Chp 15, FM 23-91)

III. ADVANCE ASSIGNMENT: Review FM 23-91, Chapters 13, 14, and 15.

IV. INTRODUCTION:

A. Gain Attention: Throughout history, commanders have used artillery for their indirect fire support. However, recent studies indicate that on future battlefields, artillery will be engaged as much as 80 percent of the time with counter-battery and other priority missions. This means you, the mortarmen of the future, must be prepared to fill this void.

B. Orient Students:

1. Lesson Tie-in: All of your previous training has to do with mechanical training or forward observer duties. Today, your training in FDC Procedures will begin.

2. Motivation: As mortarmen, the procedures taught during this instruction are imperative if you are to insure fast, accurate mortar fire.

3. Scope: During this instruction, you will receive instruction on these subjects.

NOTE: SHOW VU-GRAPH #1 (FDC Basic Training Tasks)

1. Explain the subjects that will be taught in basic 81mm mortar FDC procedures.

NOTE: VU-GRAPH #1 OFF

2. Explain local classroom procedures and give recommendations on how to use teamwork, study halls, and reviews to help in preparing for exams.

QUESTION: ASK FOR AND ANSWER ANY QUESTIONS.

V. BODY:

A. TASK: Inventory FDC equipment used as the primary means to control the fires of the 81mm mortar.

CONDITION: Given a computer's record, firing data sheet, and FDC equipment which may or may not be complete.

STANDARD: Identify all components of the 81mm mortar FDC equipment, and specify missing items, if any. (IAW Chp 15, FM 23-91)

TRANSITION: During the next two hours you will be shown the breakdown of the fire direction team, their duties, and their equipment.

1. There are four types of mortars: 4.2 inch, 81mm, 60mm and Light Weight Company Mortars (LWCMs). We will only be concerned with the 81mm mortar.

NOTE: SHOW VU-GRAPH #2 (The Indirect Fire Team)

2. The indirect fire team consists of three elements; they are Fire Support Team (FIST), FDC and Guns.

QUESTION: WHO IS THE BRAIN OF THIS FIRE TEAM? (FDC)

TRANSITION: We know that the FDC is the brain, so let's take a closer look at the Fire Direction Center.

NOTE: VU-GRAPH #2 OFF; SHOW VU-GRAPH #3 (Infantry Company: 81mm Mortar Section Fire Direction Center)

3. The 81mm mortar section's FDC consists of four personnel: mortar section leader (normally the Grade E-6), 2 computers (Grade E-5), and 1 radio telephone operator (E-3).

NOTE: VU-GRAPH #3 OFF

TRANSITION: Now that we know the personnel in the FDC, lets discuss some of their duties.

QUESTION: WHAT ARE SOME OF THE DUTIES OF THE CHIEF COMPUTER?

NOTE: SEE SLIDE - DUTIES OF CHIEF COMPUTER

NOTE: SHOW VU-GRAPH #4 (Fire Direction Chief/Chief Computer)

NOTE: DISCUSS BRIEFLY EACH DUTY OF THE CHIEF COMPUTER

NOTE: VU-GRAPH #4 OFF

NOTE: SHOW VU-GRAPH #5 (Fire Direction Computer)

4. Here we have the duties of the Fire Direction Computer:

a. Operates the M-16 plotting board.

b. Determines and announces deflection, charge, and elevation.

c. Determines angle T.

d. Replots targets for future reference.

e. Posts information on the M-16 plotting board.

f. Maintains data sheets.

NOTE: VU-GRAPH #5 OFF

TRANSITION: We have discussed some of the duties of the Fire Direction Chief and the two computers, now let's discuss the other member of the Fire Direction Team, the Radio Telephone Operator (RTO).

QUESTION: WHAT ARE SOME OF THE DUTIES OF THE RTO?

NOTE: SEE SLIDE - DUTIES OF THE RTO

NOTE: SHOW VU-GRAPH #6 (Fire Direction RTO); DISCUSS EACH DUTY BRIEFLY

NOTE: VU-GRAPH #6 OFF

QUESTION: ARE THERE ANY QUESTIONS PERTAINING TO ANY INFORMATION THAT WE HAVE COVERED?

TRANSITION: So far we have discussed the indirect fire team, the personnel, and duties of the FDC. Now let us discuss the equipment that the FDC personnel use to accomplish their mission.

NOTE: SHOW VU-GRAPH #7 (Top Half of Computer's Record)

5. The computer's record (DA Form 2399) is a worksheet used to record corrections, data, and commands during a fire mission. The computer uses a computer's record for each mission received and fired by the FDC. Let's discuss the parts of the computer's records.

A. CALL-FOR-FIRE begins every normal fire mission. It alerts the FDC to prepare to compute firing data, and supplies the target location, Observer Target (OT) direction, and description of the target.

B. FDC ORDER: As soon as the call-for-fire is received, the Chief Computer has the target plotted to see that it's within his area of responsibility. If he decides to accept the mission, he decides how the target will be engaged. Once he has made his decision, he issues the FDC order to Computers to let them know how the mission will be conducted.

1. Mortar to Fire for Effect (FFE): Specifies which mortar will participate in the FFE.

2. Mortar to Adjust: Tells which mortar(s) will fire during the adjustment.

3. Method of Adjustment: Gives the number of rounds to be fired from each adjusting mortar in each step of the adjustment, normally one round.

4. Basis for Corrections: Is only used on the survey chart, after registration has been completed.

5. Sheaf Corrections: Specifies any unusual sheaf to be fired, such as, converge-open.

6. Shell and Fuze: Is the type of fuze and shell that will be fired in the mission.

7. Method of FFE: Tells the number of rounds to be fired from each mortar in the FFE.

8. Range/Lateral Spread: Is used only with illumination ammunition. Mainly fired with the 4.2 inch mortar.

9. Zone: Is fired with 4.2 inch mortar.

10. Time of Opening Fire: Tells what control the FDC is exercising over the section, e.g., at my command (AMC) or when ready (W/R).

C. HEADING DATA: At the end of the FDC order, the Chief Computer may announce a target number if he believes the target may be of value as a future reference; target number is recorded in the upper right corner of the computer's record.

1. Vertical Interval (VI): The difference in altitude between the mortar section and the target. The sign is plus IF the target is above the mortars.

2. Charge/Range Corrections: The correction which must be applied to the chart range to compensate for VI.

3. Deflection Corrections: Only used on the survey chart for the 81mm mortar, after registration has been completed.

4. Chart Deflection: The deflection that you read from the M16 plotting board.

5. Chart Range: The range from the mortar to the plotted location of the target.

6. Angle T: The angle formed by the OT line and Gun Target (GT) line. It is significant when it is 500 mils or greater, for then the observer halves his deviation corrections.

7. Charge: The charge is read from the firing tables, by entering the table at the range you determine from the mortar to the target.

D. ELEMENTS OF THE INITIAL FIRE COMMAND:

1. Mortar to Follow: The mortar(s) which will follow the adjusting mortar(s) data, though not actually firing.

2. Shell and Fuze: The shell and fuze to be fired on the first adjusting round, or if no adjustment is to be conducted, on the FFE.

3. Mortar to Fire: The mortar(s) designated to fire.

4. Method of Fire: The adjusting mortar(s) is told how many rounds to fire, how to fire, and any special control desired. The second line warns what type and how many rounds will be fired for effect if an adjustment is conducted.

5. Deflection: The deflection which should be placed on the mortar sight.

6. Charge: The charge(s) which should be cut at the mortar section. (Number of charges on the round to be fired)

8. DATA SECTION: The most current data for registration point and target is recorded here; if the FO should call for a repeat of fires placed on one of these targets, the data can be sent directly to the section. This section consists of:

A. Target Data

B. Chart Data

C. Firing Correction

D. Firing Data

E. Intelligence

NOTE: VU-GRAPH #9 OFF

QUESTION: WHAT ARE YOUR QUESTIONS PERTAINING TO THE DATA SHEET?

TRANSITION: So far, we have covered the computer's record and data sheet, as part of the equipment used by the FDC. The most important piece of equipment that the FDC uses is the M16 plotting board.

NOTE: SHOW VU-GRAPH #10 (M16 Plotting Board)

9. The plotting board consists of a rotating disk of transparent plastic and a removable range arm, both attached to a flat grid base. Let us talk about these parts:

A. BASE: The base is a white plastic sheet connected to a magnesium alloy backing. On the base is printed a grid in red or green at a scale of 1:12,500.

1. The vertical center line is graduated and numbered upward and downward from the center (pivot point) from 0 to 3100 m. Each small grid square represents 50 m. To the left of the vertical center is an alternate range scale 0 to 6000 m.

2. The index mark is the point at which deflections or azimuths may be read to the nearest 10 mils.

3. The vernier scale is used to get greater accuracy when reading the mils scale on the azimuth disk, it permits the operator to read azimuth and deflection to the nearest one mil.

B. AZIMUTH DISK: The azimuth disk has a mil scale on the outer edge. The scale is divided into 10-mil increments from 0 to 6400 and is numbered every 100 mils; the scale increases from left to right.

C. RANGE ARM: The range arm is used when the mortar is located at the pivot point.

NOTE: VU-GRAPH #10 OFF

7. Time: The time setting to be placed on the round. (Illumination rounds only)

8. Elevation: This element serves two purposes: it gives the exact elevation setting to be placed on the mortar sight, and in the absence of controls imposed on the method of fire, it serves as the command to fire.

E. ROUNDS EXPENDED: The number and type of rounds fired is recorded in this column.

NOTE: VU-GRAPH #7 OFF

QUESTION: WHAT ARE YOUR QUESTIONS PERTAINING TO THE TOP HALF OF THE COMPUTER'S RECORD?

NOTE: SHOW VU-GRAPH #8 (Bottom Half of Computer's Record)

6. Here on the bottom portion of the computer's record you have the spaces for the following:

A. OBSERVER CORRECTIONS: Information received from the FO is recorded in this section.

B. CHART DATA: These are the deflection and charge read from the plotting equipment.

C. SUBSEQUENT COMMANDS: The items which comprise the subsequent command are the same as those which make up the initial fire command. Commands are transmitted to the section exactly as they appear on the computer's record.

NOTE: VU-GRAPH #8 OFF

QUESTION: WHAT ARE YOUR QUESTIONS PERTAINING TO THE BOTTOM HALF OF THE COMPUTER'S RECORD?

TRANSITION: We have covered the DA Form 2399 computer's record; now we will discuss another form that the FDC uses, the data sheet (DA Form 2188-R).

NOTE: SHOW VU-GRAPH #9 (Data Sheet)

7. The data sheet is used to record and maintain up-to-date information and firing data for targets. Some of the information that can be recorded onto the data sheet are:

A. Organization

B. Mortar Grid

C. Date

D. Mounting Data

E. Observation Post (OP) Grid

TRANSITION: Now that we have discussed the parts of the M16 Plotting Board, how do we use it? First of all, we must know how to read for azimuths and deflection.

10. Let's talk about how to read an azimuth. Remember when reading an azimuth, you read from left to right because the numbers increase from left to right. You always read toward the index mark.

NOTE: SHOW VU-GRAPH #11 (Vernier Scale) AND VU-GRAPH #12 (Magnified Portion of Rotating Disk) TOGETHER. USE GREASE PENCIL TO LABEL AZIMUTH SCALE ON VU-GRAPH #12 FOR EACH EXAMPLE.

QUESTION: WHAT IS THE CORRECT AZIMUTH? (5135)

STEP 1. The first two numbers you read from the left of the index mark.

STEP 2. The third number you read by counting the number of 10-mil graduations towards the index mark.

STEP 3. The fourth number you read from the vernier scale by finding one of the 10-mil graduation marks that align with one of the one-mil graduation marks on the right side of the vernier scale.

QUESTION: WHAT IS THE CORRECT AZIMUTH FOR THE READING? (5050)

NOTE: USE MORE EXAMPLES IF NEEDED

QUESTION: ARE THERE ANY QUESTIONS PERTAINING TO HOW TO READ AN AZIMUTH?

NOTE: VU-GRAPHS #11 AND #12 OFF

B. TASK: Compute data on observed firing chart.

CONDITION: Given an M16 plotting board, a call-for-fire, a computer's record, a tabular firing table, subsequent FO corrections, map of area, protractor, and data sheet.

STANDARD: Prepare the M16 plotting board as an observed firing chart, record, and analyze the call-for-fire; fill out the FDC order; complete the heading information on the computer's record; record the initial fire commands; process subsequent corrections; determine deflection to nearest one mil and range to nearest 25 m; select the correct charge and elevation; and conduct fire missions using grid, shift, and polar methods of target location. (IAW Chp 15, FM 23-91)

TRANSITION: Now that you know how to read the M16 plotting board, let's discuss the type of firing charts.

NOTE: SHOW VU-GRAPH #13 (Types of Firing Charts)

1. The three types of firing charts are:

A. The observed, which requires direction and distance.

B. Modified observed, which requires a grid coordinate to the mortar position.

C. Surveyed, which requires the grid coordinates to both the mortar and the registration point be known to surveyed accuracy.

NOTE: VU-GRAPH #13 OFF

Today we will work with the observed firing chart.

NOTE: REPEAT VU-GRAPH #5 (Fire Direction Computer)

2. As you now know, the computer is the brains of the outfit because he changes the FO information into firing data for the guns.

NOTE: VU-GRAPH #5 OFF

3. Picture yourself in a tactical situation and your platoon has stopped and set up.

NOTE: REPEAT VU-GRAPH #9 (Data Sheet)

4. The platoon leader informs you that you are now located at grid 994617?

NOTE: VU-GRAPH #9 OFF

5. You now receive a call-for-fire from the FO.

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record). WRITE IN THE INFORMATION BELOW WITH A GREASE PENCIL:

W27
FFE
GRID 976637
RADARSITE
SEC
HEQ
4 RDS
W/R

NOTE: VU-GRAPH #7 OFF

6. What do you as a computer do? Fill out the FDC order.

NOTE: SHOW VU-GRAPH #14 (Map Grid System)

7. The first step is to get out the map and plot the location of both mortar position and target. Then draw a line connecting the two together; then use your protractor and map scale to find the azimuth and the distance to the target.

NOTE: VU-GRAPH #14 OFF

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board)

8. Once you have the direction of fire (DOF) and distance to target from the map, you then set up your plotting board. First, you take the direction and round it off to the nearest 50 mils (e.g., 5660 = 5650). Next, you superimpose the deflection scale under the mounting azimuth (e.g., 5650 = 2800); remember to use the LARS rule (left add - right subtract). Now you index the exact target direction and then move from the pivot point up the index line to the target range that you measured from the map (2700 m). At this point you would plot the target on the plotting board. Now that you have plotted the target, you must get all the necessary data from the board. Make sure you have the target lined up on the vertical center line and move to the top of the board and get your initial azimuth, deflection, and chart range.

NOTE: VU-GRAPH #10 OFF

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

9. Once you have this information, you must record it on the computer's record, initial azimuth (5660) goes in time block, chart deflection (2790) in chart deflection block, and chart range (2700) in chart range block. Next you need to find the charge.

NOTE: VU-GRAPH #7 OFF

NOTE: SHOW VU-GRAPH #15 (Charge vs. Range)

10. In order to find the charge, we must use the firing tables and we must also use the minimum charge that will reach our target. To make this easy, turn to page XXXIX in the firing tables. Once you have determined the charge (chg 5), you then go to that part of the firing tables.

NOTE: VU-GRAPH #15 OFF

NOTE: SHOW VU-GRAPH #16 (Firing Table: Charge 5)

When you get to the right charge, you then find the range that you are firing (rng 2700) and go to column 2 to get your elevation (elv 0988).

NOTE: VU-GRAPH #16 OFF

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

Now you have your data to fill out and send your initial fire command. Mortar to follow (Sec), Shell and Fuze (HEQ), Method of Fire (4 rounds). Deflection (2790), Charge (5), Elevation (0988).

NOTE: VU-GRAPH #7 OFF

Once the FO observes the round, he will then send you back more information.

NOTE: REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record)

The information that he sends you will go on the bottom of the computer's record in the spaces provided. (EOM tgt destroyed. Mark tgt as CD0020.)

NOTE: VU-GRAPH #8 OFF

Once the mission has ended, there are certain things left for the computer to do.

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board)

First, you must mark the target on your board; you do this with a hollow cross.

NOTE: VU-GRAPH #10 OFF

NOTE: REPEAT VU-GRAPH #9 (Data Sheet)

The last thing the computer does is update the data sheet; that is, take all the information on the computer's record and put it in the appropriate blocks on the data sheet. (Fill out data sheet.)

NOTE: VU-GRAPH #9 OFF

Give students a 10-minute break.

TRANSITION: There are three methods of target location: grid mission, shift mission, and polar mission. You have just completed the grid mission, using an observed firing chart. During the next hour we will plot, shifting from a known point, with an observed firing chart.

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record). TELL STUDENTS TO COPY DOWN THE CALL-FOR-FIRE.

W27
P/F
SHIFT
CD0020
DIR 5860
R300
-300
PLT ASSY AREA

NOTE: TALK STUDENTS THROUGH FILLING OUT THE FDC ORDER

SEC
#2
1 RD
HEQ IN ADJ
PROX IN FFE
5 RDS
W/R

NOTE: VU-GRAPH #7 OFF

NOTE: SHOW VU-GRAPH #17 (Determining Initial Data: Shift Mission)

These are the procedures you use to compute a shift mission.

NOTE: EXPLAIN PROCEDURES

NOTE: VU-GRAPH #17 OFF

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board)

NOTE: TALK STUDENTS THROUGH THESE PROCEDURES USING THE M16 PLOTTING BOARD

NOTE: VU-GRAPH #10 OFF

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

QUESTION: WHAT IS THE INITIAL CHART DEFLECTION? (2687) AND INITIAL AZ? (5763)

QUESTION: WHAT IS THE CHART RANGE, CHARGE, AND ELEVATION? (RNG 2375, CHG 4, AND ELV 0922)

NOTE: VU-GRAPH #7 OFF

NOTE: SHOW VU-GRAPH #18 (Angle "T") AND EXPLAIN PROCEDURES

SEC
HEQ
#2
1 RD
5 RDS
PROX IN FFE
2687
4
0922

NOTE: VU-GRAPH #18 OFF

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

NOTE: COMPLETE INITIAL FIRE COMMAND WITH STUDENT

NOTE: VU-GRAPH #7 OFF

11. The FO sends his correction + 100.

NOTE: REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record)

NOTE: VU-GRAPH #8 OFF

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board) AND MAKE CORRECTION WITH THE STUDENTS.

NOTE: VU-GRAPH #10 OFF; REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record)

QUESTION: WHAT IS THE DEFLECTION AND RANGE? (DEF 2686, RNG 2475)

QUESTION: WHAT IS THE SUBSEQUENT COMMAND?

DEF 2686
CHG 5
ELV 1077

12. The FO sends his correction. 50 FFE

NOTE: VU-GRAPH #8 OFF

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board) AND MAKE CORRECTION WITH STUDENTS

NOTE: VU-GRAPH #10 OFF; REPEAT VU-GRAPH #8 (Bottom Half of the Computer's Record)

QUESTION: WHAT IS THE DEFLECTION AND RANGE? (DEF 2687, RNG 2425)

QUESTION: WHAT IS THE SUBSEQUENT COMMAND?

SEC
5 RDS
PROX
DEF 2687
CHG 4
ELV 0875

Once the FO observes the round, he will then send you back more information.

The information that he will send you will go on the bottom of the computer's record in the spaces provided. (EOM EST 20% CAS, MARK TGT CP0021.)

NOTE: VU-GRAPH #8 OFF

Once your board is updated, you update your data sheet.

NOTE: REPEAT VU-GRAPH #9 (Data Sheet)

NOTE: DEMONSTRATE HOW TO FILL OUT THE DATA SHEET.

QUESTION: WHAT ARE YOUR QUESTIONS PERTAINING TO A SHIFT FROM A KNOWN POINT MISSION?

QUESTION: BEFORE MAKING A CORRECTION, WHAT IS THE FIRST STEP? (INDEX THE OBSERVER DIRECTION)

NOTE: VU-GRAPH #9 OFF

NOTE: 10 minute break.

TRANSITION: During the next two hours we will cover Mark Center Sector (MCS) and shift from MCS.

NOTE: REPEAT VU-GRAPH #9 (Data Sheet)

NOTE: HAVE STUDENTS COPY DOWN THIS DATA ON THEIR DATA SHEET. MORTAR GRID 997-615 D OF 0100 MT A2 0100 (RD 2400) DIST 3500

NOTE: VU-GRAPH #9 OFF; REPEAT VU-GRAPH #7 (Top Half of Computer's Record) AND HAVE STUDENTS COPY CALL-FOR-FIRE. W30 MCS

NOTE: FILL OUT FDC ORDER.

#2
1 RD
WP
W/R

NOTE: VU-GRAPH #7 OFF

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board)

13. The first step is to index the direction of fire, which in this case is the same as the mounting azimuth. Place your referred deflection scale on the azimuth disk. To get the range, drop below the pivot point with the mortar position 2000 m, and 500 m to the left or right. To plot the target index and DOF from the mortar position, use the range given from the data sheet. Parallel the plot with the mortar to determine deflection, range, and charge.

NOTE: VU-GRAPH #10 OFF

QUESTION: WHAT IS THE DEFLECTION, RANGE, CHARGE AND ELV?

DEF 2400
RNG 3500
CHG 7
ELV 0987

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

NOTE: HAVE STUDENT FILL OUT THE INITIAL FIRE COMMAND

#2
WP
1 RD
2400
7
0987

NOTE: VU-GRAPH #7 OFF

NOTE: REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record)

The FO sends his direction (5750) and states mark target MCS.

NOTE: VU-GRAPH #8 OFF

TRANSITION: After updating our plotting board, we always update our data sheet. By the time we finish updating, the observer sends this call-for-fire.

NOTE: REPEAT VU-GRAPH #7 AND COPY DOWN THIS DATA.

W30
A/F SHIFT
MCS
DIR 6300
R300-200
OIL FIELD

NOTE: TALK STUDENTS THROUGH FILLING OUT THE FDC ORDER.

SEC
#2
1 RD
HEQ IN ADJ
HE
WP in FFE
2 HE
3 WP
W/R

NOTE: VU-GRAPH #7 OFF

NOTE: REPEAT VU-GRAPH #17 (Determining Initial Data: Shift Mission)

NOTE: EXPLAIN THE PROCEDURES FOR SHIFTING FROM A KNOWN POINT IF NEEDED.

NOTE: VU-GRAPH #17 OFF; REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

QUESTION: WHAT IS THE INITIAL AZIMUTH? (0200)

QUESTION: WHAT IS THE CHART RANGE, DEFLECTION, AND CHARGE?

DEF 2300
RNG 3400
CHG 7
ANGLE T (300)

QUESTION: WHAT IS THE INITIAL FIRE COMMAND?

SEC
HEQ
#2
1 RD
2 HE
3 WP
IN FFE
DEF 2300
CHG 7
ELV 1021

NOTE: VU-GRAPH #7 OFF

14. The observer spots the first round and sends back this correction: L150 + 100

NOTE: REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record)

NOTE: VU-GRAPH #8 OFF; REPEAT VU-GRAPH #10 (M16 Plotting Board) AND MAKE CORRECTION WITH STUDENTS.

NOTE: VU-GRAPH #10 OFF

QUESTION: WHAT IS THE NEW DEFLECTION AND RANGE?

DEF 2351
RNG 3450

QUESTION: WHAT IS THE SUBSEQUENT COMMAND?

DEF 2351
ELV 1005

NOTE: REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record)

NOTE: VU-GRAPH #8 OFF

15. The observer spots the next round and sends this correction: R50 - 50 FFE

NOTE: REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record)

NOTE: VU-GRAPH #8 OFF

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board) AND MAKE CORRECTION WITH STUDENTS.

NOTE: VU-GRAPH #10 OFF

QUESTION: WHAT IS THE SUBSEQUENT COMMAND?

SEC
2 HE
3 WP
DEF 2333
ELM
1021

NOTE: REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record)

FO SENDS EOM 3, OIL WELLS BURNING,
EST 10% CAS, MARK TGT CDOD22

NOTE: VU-GRAPH #8 OFF

NOTE: AFTER THE FFE, UPDATE PLOTTING BOARD AND DATA SHEET.

NOTE: Give students a 10-minute break.

TRANSITION: During the next hour you will compute a grid mission.

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record) COPY DOWN THIS CALL-FOR-FIRE.

W30
A/F GRID
990/643
EMY CONVOY
OT DIR 5900

NOTE: FILL OUT FDC ORDER

SEC
#2
1 RD
HEQ IN ADJ
HE 3
WP in FFE
3 HE
3 WP
W/R

NOTE: VU-GRAPH #7 OFF

16. The first step is to index the DOF from the gun to the target that you determine from the map. Then determine the range of the target from the mortar position, plot the target, and circle it. (DIR 6150, RNG 2900)

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board). TALK THROUGH THE STEPS WITH STUDENTS.

QUESTION: WHAT IS THE INITIAL AZIMUTH? (6150)

QUESTION: WHAT IS THE CHART DEFLECTION AND RANGE? (DEF 2450, RNG 2900)

NOTE: VU-GRAPH #10 OFF

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

QUESTION: WHAT IS THE RECORDED ANGLE "T"? (260)

NOTE: FILL OUT THE INITIAL FIRE COMMAND.

SEC
HEQ
#2
1 RD IN ADJ
3 HE
3 WP IN FFE
DEF 2250
CHG 5
ELV 0852

NOTE: VU-GRAPH #7 OFF

17. The observer spots the first round and sends this correction: R-80 + 200

NOTE: REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record)

Index the observer direction and make correction from last plot.

NOTE: VU-GRAPH #8 OFF

QUESTION: WHAT IS THE DEFLECTION AND RANGE? (DEF 2742, RNG 3100)

QUESTION: WHAT ARE THE SUBSEQUENT COMMANDS?

DEF 2742
CHG 6
ELV 0991
100 FFE

18. The observer spots the second round and sends this correction: -100 FFE

NOTE: REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record)

QUESTION: WHAT IS THE DEF AND RNG?

DEF 2734
RNG 3000

QUESTION: WHAT IS THE SUBSEQUENT COMMAND?

SEC
3 HE
3 WP
DEF 2734
ELV 1028

19. The observer sends EOM 5 trucks burning, EST 20% CAS, #1 gun R30. You do not plot this correction on the board, but you do determine the number of mils needed to move the round 30 meters, by using the mil relation formula or deflection conversion table.

NOTE: W = M 30 = 3 = 10 RNG 3000, R30

NOTE: ENTER D/C TABLE AT 3000 M, RANGE AT 30 M, THAT EQUALS 10 M. TO SUB FROM #2 GUN CHART DEF.

You apply the number of mils to the last fired deflection using the LARS rule.

QUESTION: WHAT IS THE SUBSEQUENT COMMAND FOR #1 GUN? #1 DNF DEF 2724.

20. Since the guns now have different deflections, we would have them refer to the base gun deflection. In this case, we will use 2734.

QUESTION: WHAT ARE THE SUBSEQUENT COMMANDS?

SEC
DNF
DEF 2734
REFER/REALINE AIMING POSTS

NOTE: VU-GRAPH #8 OFF

NOTE: UPDATE PLOTTING BOARD AND DATA SHEET. MARK TGT CD0023

NOTE: Give students 10-minute break.

TRANSITION: So far we have located targets by the shift from a known point method and by the grid method. During the next hour we will compute a fire mission using the polar method.

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record) AND COPY DOWN CALL-FOR-FIRE.

W30
A/F POLAR
DIR 5380
DIST 2350
ENY OP
W/COVER
MTO ANGLE T = 800

NOTE: VU-GRAPH #7 OFF

21. In order to plot a polar mission, we must know the observer location, either by grid or resection. Since we are working on the observed firing chart, we must locate the OP by resection. In order to do so, we must have two known points or targets that the observer can identify. The observer can see target MCS (AZ 5010) and CD0023 (AZ5730).

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board)

NOTE: TALK STUDENTS THROUGH THE PROCEDURES OF RESECTION.

22. The first step is to index the azimuth of either target. For MCS index azimuth 5010, draw a line from the target straight down the board, rotate the board to the azimuth for target CD0023, repeat the previous step. Where the two lines intersect is the location of the OP. After locating the OP, the next step is to index the observer's direction (5380), and from the OP position, go a distance of 2350 m, place a small dot, circle it, and label it number 1. Aline the new plot with the mortar position and determine the initial azimuth.

NOTE: VU-GRAPH #10 OFF

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

QUESTION: WHAT IS THE INITIAL AZIMUTH? (6153)

QUESTION: WHAT IS THE CHART DEF, RNG, ANGLE T, AND CHG?

DEF 2747
RNG 3950
CHG 8
ANGLE T 770

NOTE: FILL OUT THE INITIAL FIRE COMMAND

SEC
HEQ
#2
1 RD IN ADJ
2 RD HED IN FFE
DEF 2747
CHG 8
ELV 0960

NOTE: VU-GRAPH #7 OFF

The observer spots the first round and sends this correction: L100 + 400

NOTE: REPEAT VU-GRAPH #8 AND MAKE CORRECTION WITH STUDENTS.

QUESTION: WHAT IS THE CORRECT DEFLECTION AND RANGE?

DEF 2832
RNG 4200

The observer spots the second round and sends this correction: -100

QUESTION: WHAT IS THE SUBSEQUENT COMMAND?

DEF 2818
ELV 0879

The observer spots the third round and sends +50 FFE.

QUESTION: WHAT IS THE CHART DATA?

DEF 2823
RNG 4150

NOTE: VU-GRAPH #8 OFF

NOTE: SHOW VU-GRAPH #19 (Converge Sheaf)

TRANSITION: Since the FO has requested a FFE and the target description is an OP, we must first determine the data to converge the sheaf before we can formulate the subsequent command.

NOTE: VU-GRAPH #19 OFF

NOTE: SHOW VU-GRAPH #20 (Deflection Conversion Table) AND EXPLAIN HOW TO USE IT.

NOTE: VU-GRAPH #20 OFF

NOTE: REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record)

QUESTION: WHAT ARE THE DEFLECTIONS FOR THE NUMBER ONE AND THREE GUNS?

DEF #1 2833
DEF #3 2813

QUESTION: WHAT IS YOUR SUBSEQUENT COMMAND?

SEC
2 RD
HED
DEF #1 2833
DEF #2 2823
DEF #3 2813
ELV 0862

The FO sends EOM, OP destroyed, mark as TGT CD0024.

NOTE: VU-GRAPH #8 OFF

NOTE: Give students a 10-minute break.

C. TASK: Compute firing data using the M16 plotting board as a modified observed firing chart.

CONDITION: Given either the mortar location or target location within 10 m; an M16 plotting board; a map with situation overlay; a computer's record, data sheet, and tabular fire table.

STANDARD: Plot the known location to the nearest 10 m and transfer firing data from the observed firing chart; determine deflection to the nearest 10 mils and range to the nearest 25 m; select the correct charge and elevation; update data sheet and conduct fire missions using grid, shift, and polar methods of target location. (IAW Chp 15, FM 23-91)

TRANSITION: We know that there are three types of firing charts: observed, modified observed, and surveyed. We have covered the observed chart, and we know that it is the fastest chart for computing data. Let's talk about the chart used in most units: the modified observed chart.

1. Selecting and numbering the grid system requires careful selection of the grid intersection to represent the pivot point because the pivot point is approximately 150 m in diameter on which a target cannot be plotted. The computer must select the grid intersection so that the pivot point will not interfere with the area of operation. This can be done by selecting a grid intersection which is outside the area of operation. However, the intersection should be as close to the area of operation as possible.

NOTE: REPEAT VU-GRAPH #14 (Map Grid System)

The grid intersection which represents the pivot point should be 1500 to 2000 m in front of the mortar position. By selecting these coordinate designators properly, the mortars, when located by coordinates, will be positioned so their maximum range can be obtained on the plotting board.

QUESTION: WHAT IS THE BEST GRID INTERSECTION TO REPRESENT THE PIVOT POINT? (5125)

NOTE: VU-GRAPH #14 OFF

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board)

2. To place a coordinate system on the plotting board:

a. Rotate the azimuth disk until zero is oriented at the index mark. This will orient the vertical lines on the plotting board to a north-south direction, the same as the vertical lines on a map.

NOTE: FOR TODAY'S PROBLEM, WE WILL USE A GRID OF 01/63 TO REPRESENT THE PIVOT POINT.

NOTE: VU-GRAPH #10 OFF; REPEAT VU-GRAPH #9 (Data Sheet) WITH THE FOLLOWING INFORMATION:

DIR OF FIRE 0840
MT AZ 0850
RD 2800
MORT GRID 00386140
ORGAN 023614
MORT AIT 530
OP AIT 550
GRID/INT 01/63

NOTE: VU-GRAPH #9 OFF

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board)

b. Superimpose the grid designator 2000 m below the pivot point in the vertical center line. Superimpose an additional two grid designators to the right and left in 1000 m intervals. Remember, each large grid square equals 500 x 500 m.

c. Superimpose the horizontal grid designator 2000 m to the left of the pivot point. Superimpose an additional two horizontal grid designators both up and down in the same manner as the vertical designators.

TRANSITION: Now that we have a coordinate system superimposed on the plotting board, we can plot the position of the mortars on the plotting board. The coordinates of the mortar position are 00386140.

3. With the azimuth disk indexed to 0 at the index mark, the mortar position can be plotted using map reading procedures. Enclose the mortar position with a hollow cross and mark it with an "M" in the upper right hand corner and the altitude in the lower left.

Rotate the azimuth disk until you read the rounded off direction of 0850 mils. Using the LARS rule, superimpose the deflection 400 mils to the left and right of azimuth 0850. Insure you move 100 mils each time.

NOTE: VU-GRAPH #10 OFF

D. TASK: Perform the duties of safety officer in conjunction with the FDC.

CONDITION: Given the right and left limit azimuth; maximum and minimum ranges; charges and ammunition which may be fired; an 8-digit grid coordinate for a mortar position; a range safety diagram; a mounting azimuth; and a referred deflection.

STANDARD: The right and left limit deflections will be determined within 0 mil, the charge and elevation combinations for maximum ranges must be recorded without error and the margin data must be recorded on the range safety diagram IAW FM 23-91.

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board)

TRANSITION: Now that we have our board set up as a modified observed chart, are we ready to accept a fire mission? No, we must always consider safety. We must construct a safety diagram for our firing position.

NOTE: VU-GRAPH #10 OFF

1. You must obtain a safety card when firing on any range. You can get this card from range control.

2. There is certain information that we must take off the safety card and place on our safety diagram:

a. Type of weapon: 81mm

b. The 8-digit coordinate: 00386140

c. Charge/zone: 1/9

d. Left and right limit azimuths: L0440 R1240

e. Minimum and maximum ranges: Min 300 Max 4000

NOTE: SHOW VU-GRAPH #21 (Safety Diagram)

NOTE: HAVE STUDENTS PLACE DATA ON SAFETY DIAGRAM

3. Once we have the data on the safety diagram, we can determine all of the necessary information that is needed. First, we can determine the direction of fire by adding the left and right limit azimuths together and divide it by two. This will give us our direction of fire (DOF 0840). You will round off your DOF to the nearest 50 mils for the mounting azimuth - 0850. We know our referred deflection is 2800 mils, so we would report it on the safety diagram.

4. The next thing we want to determine is the difference in mils for the left and right limit azimuths from the mounting azimuth. We do this by subtracting the smaller from the larger.

QUESTION: WHAT IS THE NUMBER OF MILS DIFFERENCE BETWEEN THE LEFT LIMIT AZIMUTH AND THE MOUNTING AZIMUTH? (410)

For each azimuth there is a corresponding deflection.

QUESTION: HOW CAN WE DETERMINE THE CORRESPONDING DEFLECTIONS FOR THE RIGHT AND LEFT LIMIT AZIMUTHS? (USING THE LARS RULE, FOR THE LEFT LIMIT ADD 410 + 2800 = 3210, FOR THE RIGHT LIMIT, 2800 - 390 = 2410.)

NOTE: TAKE OUT FIRING TABLE.

We must determine the maximum elevation for the maximum range and charge, and the minimum elevation for the maximum range.

NOTE: EXPLAIN PROCEDURES FOR USING FIRING TABLE.

NOTE: VU-GRAPH #21 OFF

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board)

4. Now that we have this data, we must construct a safety fan on the M16 plotting board.

a. You may index either the left or right limit azimuth; however, for classroom purposes we will start with the left. Once we have the left limit azimuth indexed, go up 300 m from the mortar position on the same vertical line and place a very small dot. From this dot continue until you reach the range of 4000 m and place a dot. Connect the two dots with a line.

b. Repeat these procedures in for the right limit.

c. To make the safety fan arc, use a straight edge marked with the minimum and maximum ranges. Keeping the edge on the mortar location, rotate the straight edge between the left and right limits.

NOTE TO INSTRUCTOR: EXPLAIN THE DIFFERENCE BETWEEN RANGE TO BURST AND RANGE TO IMPACT OF ILLUMINATION AMMUNITION.

NOTE: VU-GRAPH #10 OFF

QUESTION: HOW DO WE DETERMINE THE DIRECTION OF FIRE USING THE LEFT AND RIGHT LIMIT AZIMUTHS? (BY ADDING THE TWO TOGETHER AND DIVIDING BY TWO.)

NOTE: Give students a 10-minute break.

TRANSITION: You now have the plotting board set up as a modified observed chart with the safety fan on it. Based on the platoon leader's information and this call-for-fire, record and determine data for the first round.

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record), INCLUDING AN APPROPRIATE EXAMPLE OF A CALL-FOR-FIRE.

NOTE: HAVE STUDENTS COPY DOWN CALL-FOR-FIRE ON THE COMPUTER'S RECORD.

NOTE: FORMULATE THE FDC ORDER, HEADING, AND INITIAL FIRE COMMAND WITH STUDENTS.

QUESTION: WHAT IS THE CHART DEFLECTION?

NOTE: VU-GRAPH #7 OFF

TRANSITION: Before we fire the first round, let's consider the correction necessary for a difference in altitude. By using the contour lines on the map, we can determine the altitude of both the mortar position and the target.

Altitude of mortar position = 530 m, altitude of target location = 430 m.

NOTE: SHOW VU-GRAPH #22 (Vertical Interval)

5. This is an example of a mortar position and target. As you can see, the target is at a greater altitude (300 m) than the mortar position (200 m). If the range from the mortar position to the target is 3000 m and we were to fire a round at 3000 m, the round would fall short of the target because of the difference in altitude (100 m). The round would in fact strike the ground at a range of 2950 m. In order to hit the target, we must make a correction for a difference in altitude. Make the correction as follows:

a. Altitude corrections are made only when differences of 50 m or more exist in VI.

b. Correct the initial range by one-half the difference in VI.

c. The sign is plus (+) if the target is above the mortar and minus (-) if it is below. In this example, the corrected range is 3050 m.

NOTE: VU-GRAPH #22 OFF; REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record) INCLUDING AN APPROPRIATE FO CORRECTION.

NOTE: FORMULATE CHART DATA AND SUBSEQUENT COMMAND AND RECORD ON COMPUTER'S RECORD.

NOTE: HAVE STUDENTS APPLY THIS CORRECTION TO THE RANGE EACH TIME THE MORTAR IS FIRED UNTIL THE MISSION IS COMPLETED.

QUESTION: WHAT IS THE CHART RANGE?

NOTE: INSTRUCTOR PROVIDES AN APPROPRIATE FO EOM STATEMENT; VU-GRAPH #8 OFF.

NOTE: HAVE STUDENTS UPDATE DATA SHEET AND PLOTTING BOARD.

NOTE: Give students a 10-minute break.

TRANSITION: Your platoon leader informs you to forward plot the two targets fired on the last observed chart.

NOTE: REPEAT VU-GRAPH #9 (Data Sheet) WITH DATA FOR THE LAST TWO TARGETS ON LAST OBSERVED CHART.

NOTE: HAVE STUDENTS COPY DOWN THIS DATA.

NOTE: VU-GRAPH #9 OFF.

6. To forward plot, rotate your board to the deflection 2813 and count from the mortar position to a range of 3400 m. Place a dot and mark it with a hollow cross and label it AB0053. Repeat the same procedures for target AB0054.

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record), INCLUDING AN APPROPRIATE EXAMPLE OF A CALL-FOR-FIRE.

NOTE: HAVE STUDENTS COPY DOWN CALL-FOR-FIRE.

NOTE: HAVE STUDENTS FILL OUT FDC ORDER.

7. To plot the first round, orient the plotting board to the observer's direction given in the call-for-fire. Plot target location given the call-for fire, circle it, and label it number 1. To determine the deflection, rotate the disk until the mortar position and the number 1 plot are aligned. Determine the deflection and the range from the mortar position to plot number 1.

NOTE: VU-GRAPH #7 OFF.

NOTE: STUDENTS SHOULD DETERMINE A DEFLECTION WITHIN TEN MILS AND A RANGE WITHIN 25 M.

NOTE: HAVE STUDENTS FORMULATE AND COMPLETE HEADING AND INITIAL FIRE COMMAND. INSTRUCTOR SHOULD VERIFY DATA.

QUESTION: WHAT IS THE RECORDED ANGLE T?

NOTE: REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record)

TRANSITION: After firing the first round, the observer calls back the first correction: LEFT 50 - DROP 100

8. Determine the deflection within 10 mils and the range within 25 m.

NOTE: HAVE STUDENTS RECORD CHART DATA AND SUBSEQUENT FIRE COMMAND ON COMPUTER'S RECORD. THE INSTRUCTOR SHOULD VERIFY THE DATA.

TRANSITION: After firing the second round, the observer sends back the following correction: + 50 FFE

9. Determine data to the nearest 10 mils in deflection and 25 m in range.

NOTE: HAVE STUDENTS RECORD CHART DATA AND SUBSEQUENT FIRE COMMAND ON COMPUTER'S RECORD. THE INSTRUCTOR SHOULD VERIFY DATA.

QUESTION: WHAT ARE THE DEFLECTIONS FOR THE #1 GUN AND #3 GUN?

TRANSITION: The observer sends an appropriate EOM statement.

NOTE: VU-GRAPH #8 OFF; UPDATE PLOTTING BOARD AND DATA SHEET.

NOTE: Give students 10-minute break.

TRANSITION: While you were on break, we received this call-for-fire.

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record).

NOTE: HAVE STUDENTS COPY DOWN CALL-FOR-FIRE

W27
A/F GRID
033629
MISSILE
SITE
ALT 450
OT DIR 1400

NOTE: FILL OUT FDC ORDER

SEC
#2
1 RD
HEQ
4 RDS
W/R

NOTE: VU-GRAPH #7 OFF

NOTE: SHOW VU-GRAPH #23 (Determining Initial Data: Grid Mission)

NOTE: EXPLAIN EACH STEP

NOTE: VU-GRAPH #23 OFF

QUESTION: WHAT IS THE RANGE CORRECTION? -40

QUESTION: HOW DO WE DETERMINE ANGLE T?

NOTE: HAVE STUDENTS FORMULATE THE INITIAL FIRE COMMAND

SEC
HEQ
#2
1 RD
4 RD in FFE
DEF 2535
CHG 6
ELV 0933

TRANSITION: After firing the first round, the observer sends this correction: R 200, -150

QUESTION: WHAT IS THE SUBSEQUENT COMMAND?

TRANSITION: Observer calls back a correction of L100, +100.

QUESTION: WHAT IS THE SUBSEQUENT COMMAND? DEF 2509, ELV 0969

TRANSITION: The observer sends this correction: R50, -50 FFE.

NOTE: HAVE STUDENTS RECORD DATA AND SUBSEQUENT FIRE COMMAND ON COMPUTER'S RECORD.

SEC
4 RDS
DEF 2498
CHG 6
ELV 1001

NOTE: OBSERVER CALLS BACK EOM, 2 MISSILES DESTROYED.

NOTE: UPDATE DATA SHEET AND PLOTTING BOARD

NOTE: Give students a 10-minute break.

QUESTION: WHAT MUST WE KNOW IN ORDER TO PLOT A POLAR MISSION? (OBSERVER LOCATION)

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

NOTE: HAVE STUDENTS COPY DOWN CALL-FOR-FIRE

W27
A/F POLAR
DIR 0390
DIST 1800
DN 100
TROOPS IN OPEN

NOTE: FORMULATE FDC ORDER

NOTE: VU-GRAPH #7 OFF

NOTE: SHOW VU-GRAPH #24 (Determining Initial Data: Polar Mission)

NOTE: TALK STUDENTS THROUGH PROCEDURES FOR DETERMINING INITIAL DATA FOR A POLAR MISSION

NOTE: VU-GRAPH #24 OFF

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

QUESTION: WHAT IS THE INITIAL HEADING DATA?

NOTE: VU-GRAPH #7 OFF

NOTE: REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record)

Observer sends this correction: R100, +50

QUESTION: WHAT IS THE CORRECT DEFLECTION? DEF 2621
ELV 0980
CHG 6

Observer spots the round and sends, L50, -25 FFE.

QUESTION: WHAT IS THE SUBSEQUENT COMMAND?

SEC
3 RDS
PROX
DEF 2629
CHG 6
ELV 1001

Observer sends EOM, EST 75% CAS.

NOTE: VU-GRAPH #8 OFF

NOTE: UPDATE PLOTTING BOARD AND DATA SHEET

NOTE: Give students a 10-minute break.

TRANSITION: So far in FDC procedures we have conducted fire missions using the M16 plotting board as an observed firing chart and a modified observed chart. The M16 plotting board also can be constructed as a surveyed firing chart when two points are known to be surveyed accurately.

E. TASK: Prepare a surveyed firing chart.

CONDITION: Given an M16 plotting board, a surveyed mortar location, and a surveyed target location.

STANDARD: Place a coordinate system on the M16 board, plot the mortar and target locations to the nearest 10 m, compute the mortar target azimuth to the nearest 1 mil. (IAW Chp 15, FM 23-21)

1. When preparing a surveyed firing chart, we must have a mortar location and a registration point (RP) known to be surveyed accurately to at least an eight digit grid coordinate.

NOTE: REPEAT VU-GRAPH #9 (Data Sheet) WITH MORTAR GRID 00866158, OR RP GRID 99485875, GRID INTERSECTION 01/59 REPRESENTING THE PIVOT POINT, AND ALTITUDE FOR MORTAR 520 AND RP 420.

NOTE: HAVE STUDENT COPY INFORMATION NEEDED TO CONSTRUCT A SURVEYED CHART.

The first thing you must do in preparing the chart is place the grid system on the board. To do this, first orient the azimuth disk to north or index 0.

NOTE: VU-GRAPH #9 OFF; REPEAT VU-GRAPH #10 (M16 Plotting Board)

Now, we can place our grid system on the board. We have determined that the grid intersection we are going to use is 01/59. The 01 will be placed 2000 m below the pivot point and the 59 2000 m left of the pivot point. At this time, we will continue placing the grid system on the board making sure to number every other heavy grid line and increasing the numbers right and up.

NOTE TO INSTRUCTOR: MAKE SURE EACH STUDENT HAS GRID SYSTEM ON PLOTTING BOARD CORRECTLY.

TRANSITION: Now that we have a coordinate system superimposed on the plotting board, we can plot the position of the mortar and the RP on the plotting board. The coordinates of the mortar position are 00866158.

2. How would you plot the coordinates of the mortar position on the plotting board?

a. First insure zero is indexed at the index mark.

b. Locate the lower left corner of the grid square that the mortars are located in 00 61 grid intersection.

c. Using map reading procedures (reading right and up) plot the mortar position to the nearest 10 m, keeping in mind that each large square on the plotting board represents 500 x 500 m and each small square represents 50 x 50 m. From the 00 line go to the right 860 m and from that same point, go straight up from the 61 line 580 m. Place a small dot at this point. Since this is a surveyed grid coordinate, place a hollow cross around the dot. In the upper left corner of the hollow cross, place an "M" to represent mortar position and an "S" to represent survey point. In the lower left corner of the hollow cross, place the altitude of that position.

d. The RP will be plotted in the same manner with the exception of marking. The letters "RP" will be placed in the upper right position of the hollow cross around this point.

e. Once the two surveyed points are plotted, determine the direction of fire and the mounting azimuth by rotating the azimuth disk until the RP is aligned directly above the mortar position. Then, read the azimuth from the vernier scale to the nearest 1 mil. This reading would be recorded as direction of fire on the data sheet. This direction of fire is rounded off to the nearest 50 mils to obtain a mounting azimuth which is announced to the section sergeant. He, in turn, will announce a referred deflection to the FDC. The referred deflection is placed on the plotting board to correspond to the mounting azimuth.

EXAMPLE: Direction of fire = 3660

Mounting azimuth = 3650

Referred deflection = 2800

f. The referred deflection is placed on the azimuth disk underneath the mounting azimuth. Other corresponding deflections are placed on the azimuth disk approximately 400 mils left and 400 mils right of the referred deflection.

NOTE: VU-GRAPH #10 OFF

TRANSITION: We are now ready to conduct the survey registration. In this situation we have already coordinated with the FO. When he is in position to observe the registration point, the FDC can initiate the registration mission. This is called a coordinated registration.

F. TASK: Compute a registration mission.

CONDITION: Given a computer's record, firing tables, M16 plotting board, and the decision to register and parallel the sheaf.

STANDARD: Compute initial and subsequent firing data and determine firing data corrections (if any) for paralleling the sheaf IAW Chap 15, FM 23-91.

The following call-for-fire is issued:

MTO	Initial Azimuth = 3660
Prepare To	Initial Chart Rng = 3150
Reg RP1	Initial Chart Def = 2790

NOTE: OT DIR 3800

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record). FILL OUT FDC ORDER AND FORMULATE INITIAL FIRE COMMAND.

SEC	SEC
#2	HEQ
1 RD	#2
HEQ	1 RD
W/R	DEF 2790
	CHG 6
	ELV 0980

1. Determine the VI and range correction for VI. The altitude for the mortar position is 520 m and altitude for the RP is 470 m.

MORTAR ALT = 520
RP ALT = 470
VI = -50 divided by 2 = -25 rng correction for VI

NOTE: VU-GRAPH #7 OFF

NOTE: HAVE STUDENTS APPLY THIS -25 RNG CORRECTION TO EACH CHART RANGE FOR EACH OBSERVER CORRECTION THROUGHOUT THE MISSION.

2. Once the observer has completed adjusting on the RP by splitting a 50 m bracket, he will send EOM, REG complete.

3. The FDC will, in turn, send a message to the observer, prepare to adjust sheaf. The observer will respond with either section left or section right. At that time, all guns except for the adjusting gun will fire one round at 10 second intervals. The observer will spot each round separately and determine the correction for each gun to parallel the sheaf. The FDC will use the deflection conversion table to make the observer correction for each gun. If a correction of 50 m or more is given for either one of the guns, that gun must be refired.

NOTE: NEED ALL SUBSEQUENT CORRECTIONS FOR SHEAF ADJUSTMENT AND COMPLETION

S/R
#1 L30
#3 R/0

TRANSITION: Once registration and sheaf adjustment has been completed, the FDC must determine the firing correction.

a. To determine the deflection correction, compare the initial chart deflection and the final chart deflection; subtract the smaller from the larger. The result will be the deflection correction. If the final chart deflection is larger than the initial chart deflection, then the deflection correction will be a left deflection correction. If the final chart deflection is smaller than the initial chart deflection, then the deflection correction will be a right deflection correction.

EXAMPLE: Initial chart deflection = 2790
Final chart deflection = 2801
Deflection correction = L11

b. To determine the range correction, compare the initial chart range to the final chart range and subtract the smaller range from the larger range. The result will be the range correction. If the final chart range is larger than the initial chart range, then the range correction will be a plus (+) correction, and vice versa.

EXAMPLE: Final chart range = 3275
Initial chart range = 3150
Range correction = +125

c. Range correction factor. Before the range correction factor (RCF) can be determined, the range correction must be determined. The RCF is determined by dividing the range correction by the chart range to the registration point, rounded off to the nearest 100 m and expressed in thousands. The RCF will be used per thousand meters for any target within the transfer limits of the surveyed registration point.

EXAMPLE: Initial chart range to RP = 3150. To nearest 100 m = 3200. Expressed in thousands = 3.2. Divide into range correction to get RCF.

```
      39.0  Rounded off to nearest whole number
3.2/+125
     96
     290          RCF = +39
     288
      2
```

NOTE: THE DEFLECTION CORRECTION AND THE RCF ARE USED FOR ALL OTHER TARGETS WITHIN THE TRANSFER LIMITS OF THE REGISTRATION POINT. THE DEFLECTION IS APPLIED TO ANY DEFLECTION TO GET COMMAND DEFLECTION, AND THE RCF IS MULTIPLIED BY THE INITIAL CHART RANGE TO OTHER TARGETS. THE CHART RANGE MUST BE ROUNDED OFF TO THE NEAREST 100 M AND EXPRESSED IN THOUSANDS IN ORDER TO DETERMINE RANGE CORRECTION FOR THAT TARGET.

TRANSITION: Once registration has been completed and the firing correction has been determined, we should have more accurate fire on other targets within the transfer limits of the registration point, if we use the correction that we have determined.

NOTE: HAVE STUDENTS UPDATE PLOTTING BOARD AND DATA SHEET.

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record) WITH THIS CALL-FOR-FIRE (SHIFTING FROM RP TRC MISSION):

W28
A/F SEC SHIFT
RP1
DIR 3550
R200, -100
P.I.O.
Prox. in FFE

a. Fill out FDC order and have students plot the target.

b. This target is within the transfer limits of RP1, so the deflection correction that we determine will be applied to all chart deflections to get the command deflection and the RCF will be used to determine range corrections for this target. Also by applying any range correction for VI, the total range correction (TRC) can be determined, which would then be applied to the chart range to get command range.

EXAMPLE: Initial Chart Def. = 2719, Def. Corr. = L11, Comm. Def. = 2730, Initial Chart Rng. = 3075 (rounded off to nearest 100 m = 3100) or expressed in thousands = 3.1 x RCF +39 = 120.9, rounded off to nearest whole number = Rng. Corr. of +121 for this target. VI = -50 divided by 2 = -25 Rng. Corr. for altitude. Rng. Corr. = +121, Alt. Corr. = -25, TRC = +96. This +96 will be applied to each chart range during the adjustment to get command range.

NOTE: VU-GRAPH #7 OFF

TRANSITION: In order for your section to be able to continue delivering accurate fire on a target, a re-registration should be conducted every 4 to 6 hours or anytime drastic changes in weather conditions are noticed.

G. TASK: Determine data from a re-registration and apply corrections.

CONDITIONS: Given a registration point and a directive to re-register and to determine the corrections to apply, FDC equipment, and firing data sheet.

STANDARD: Determine firing data for re-registration and apply corrections. Determine deflection to nearest one mil, range to the nearest 25 m, IAW Chap 13, FM 23-91.

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record).

CALL-FOR-FIRE	FDC ORDER	INITIAL FIRE COMMAND
MTO	#2	#2
PREPARE TO	1RP	HEQ
RE-REG	RP1	1RD
RP1	HEQ	DEF 2801
DIR 3800	W/R	CHG 6
		ELV 0919

NOTE: VU-GRAPH #7 OFF; REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record)

INIT CHART RANGE 3150
ADJ COMMAND + 1/2 VI 3225
3.2| +75 = 23.4 = 23 RCF

CHART DEF 2790
COMMAND DEF 2788
R2 DEF CORR

NOTE: VU-GRAPH #8 OFF

H. TASK: Perform the integrated function of a FDC computer in determining and applying meteorological corrections.

CONDITION: Given two messages, DA Forms 2601-1 and 3675, registration point, M16 plotting board, location of the mortars and target, and FT 81-AI-3.

STANDARD: Compute the deflection corrections within one mil and the range corrections within one meter. Apply the corrections without error. (IAW Chp 15, FM 23-91)

1. In many situations you will be unable to re-register and determine corrections because of tactical restrictions. Our only alternative is to compute a MET message and apply the corrections derived from it.

NOTE: SHOW VU-GRAPH #25 (Standard Conditions) AND EXPLAIN STANDARD WEATHER CONDITIONS.

a. Met corrections are corrections for variation from standard weather effects as they influence the round in flight. Since these weather effects can be determined and corrected, they are referred to as "known" errors. They only affect the exterior ballistics of the projectile.

b. There are other errors that can be corrected only by registration. These are referred to as "unknown" errors and they affect interior ballistics, (e.g., wear of the bore).

c. We also need to remember that registration actually corrects for both "known" and "unknown" errors simultaneously, since both types are included in the final adjusted data to hit the registration point.

d. Registration offers a decided advantage since it corrects for both types of errors; however, you may not always be able to fire a re-registration to determine current firing corrections. Your only alternative then will be to compute a MET message and apply the resulting corrections.

NOTE: VU-GRAPH #25 OFF

NOTE: SHOW VU-GRAPH #26 (Zone Height) AND EXPLAIN.

2. When computing a MET message, always use command data because the highest point that the round ascends is the line number that should be used to compute the MET.

NOTE: VU-GRAPH #26 OFF

NOTE: SHOW VU-GRAPH #27 (Ballistic MET Message 81mm) AND HAVE STUDENTS RECORD INFORMATION.

NOTE: VU-GRAPH #27 OFF

NOTE: SHOW VU-GRAPH #28 (Ballistic MET Message: DA FORM 3675) AND EXPLAIN HOW THE MET MESSAGE IS RECORDED.

CORR RNG	3250	DOF	3660
ELV	0919	ALT FO	520
CHG	6	R/W	770

3. Once the MET message has been recorded on DA Form 3675, the line number that we must use will be determined by entering the Firing Table at the command range (3250) to the RP. Column 5 will indicate the line number that we must use to compute the MET.

NOTE: VU-GRAPH #28 OFF

NOTE: SHOW VU-GRAPH #29 (Table D: Basic Data) AND EXPLAIN.

4. We have determined that line three (3) is the line number that we must use. It is a good practice to line through all other lines on DA Form 3675 or circle the line we will use to prevent us from accidentally using information from another line.

NOTE: VU-GRAPH #29 OFF

NOTE: SHOW VU-GRAPH #30 (Top Half of MET Data Correction Sheet for Mortars: DA FORM 2601-1) AND EXPLAIN HOW TO RECORD ALL KNOWN DATA AND DATA FROM THE MET MESSAGE

5. The H correction is the correction for air temperature and air density, due to a difference in altitude between the mortar section and the MET station.

NOTE: VU-GRAPH #30 OFF

NOTE: SHOW VU-GRAPH #30 (Table B: Temperature and Density Corrections) AND EXPLAIN HOW H CORRECTIONS ARE DETERMINED FROM TABLE B, APPLY CORRECTIONS TO DETERMINE CORRECTED VALUES.

NOTE: VU-GRAPH #31 OFF

6. The chart direction of wind is determined by comparing the direction of wind from the MET message with direction of fire, using the method described in the MET study guide. The chart direction of wind is used to enter Table A to determine crosswind and range wind components. Crosswind and range wind velocity is taken from the MET message.

NOTE: SHOW VU-GRAPH #32 (Table A: Wind Components) AND EXPLAIN HOW WIND COMPONENTS ARE DETERMINED; RECORD ON DA FORM 2601-1.

NOTE: VU-GRAPH #32 OFF

NOTE: REPEAT VU-GRAPH #29 (Table D: Basic Data).

Explain how the correction factor is determined (column 7).

NOTE: VU-GRAPH #29 OFF

Compute and determine deflection correction to nearest whole number.

NOTE: SHOW VU-GRAPH #33 (Table C: Propellant Temperature)

Determine the known value for powder temperature and record.

NOTE: VU-GRAPH #33 OFF

Compare the known and standard values and determine the variations.

NOTE: SHOW VU-GRAPH #34 (Table D: Correction Factors)

7. Columns 8 through 15 give you your unit corrections.

a. Multiply variations from standard time unit corrections to enable you to determine range corrections (either plus or minus).

b. Round off to the nearest one meter.

NOTE: VU-GRAPH #34 OFF

QUESTION: ASK FOR AND ANSWER ANY QUESTIONS ABOUT MET.

NOTE: Give students a 10-minute break.

The corrections determined from this MET message will simply be recorded and will become standard weather conditions for you. Several hours later, registration being impossible, you could compute a second MET message, determine the difference between this current message and the previous message, and apply this difference as firing corrections to compensate for the change in weather since the last message. A point to remember is that you must always have two MET messages at intervals to determine a change in weather. Normally, this interval is 2-4 hours. Furthermore, keep in mind that to compute MET message corrections, the altitude of the mortar section must be known. Thus, when working with an observed firing chart, which does not include a surveyed mortar location, MET corrections cannot be determined.

TRANSITION: This is the basic theory of applying MET corrections. Let us now concern ourselves with the practical application of determining and applying MET corrections in a realistic situation. I feel you will better understand the application of MET corrections if you construct a firing chart and apply the corrections as they would normally be applied.

NOTE: SHOW VU-GRAPH #35 (MET Cross)

1. To facilitate the determination of the corrections to apply to the difference between the first and second MET messages, we can use what is known as a MET cross.

2. Give examples of MET corrections for deflection and range.

3. Explain that the corrections are made from MET message to MET message, for both deflection and range.

NOTE: VU-GRAPH #35 OFF

TRANSITION: Once we have determined the corrections to apply, we must update all previously fired targets and use those corrections with any other target in those transfer limits.

4. Have students update targets previously fired.

QUESTION: ASK FOR AND ANSWER QUESTIONS PERTAINING TO DETERMINING AND APPLYING MET CORRECTIONS.

VI. CONCLUSION:

A. Retain Attention: Effective fire placed on a target requires the combined effort of the entire indirect fire team. Since the M16 plotting board is the primary means of control for the 81mm mortar, computers must be accurate in determining firing data as quickly as possible.

B. Summary: During the past 30 hours, you have been taught the basic procedures for computing 81mm mortar-fire missions with the M16 plotting board.

C. Application: As a FDC computer, you must retain a working knowledge of the M16 plotting board to insure the timely delivery of accurate mortar fires.

D. Closing Statement: Mortar fires can be the difference between mission success or failure of a company or battalion. A well-trained FDC computer is an essential part of the Indirect Fire Team. If you perform as you have been trained, the enemy will learn why mortar fires cause more casualties than any other weapon in the infantry.

APPENDIX B

FIRE DIRECTION CENTER PROCEDURES II: LESSON OUTLINE

I. INSTRUCTIONAL INTENT: Soldiers have completed training in basic 81mm mortar Fire Direction Center (FDC) procedures. Soldiers will now receive instruction in advanced 81mm mortar FDC procedures.

II. TRAINING OBJECTIVES: As a result of this instruction, the student must accomplish the following training objectives:

A. TASK: Compute a traverse mission.

CONDITION: Given an M16 plotting board, computer's record, a call-for-fire, and a tabular firing table.

STANDARD: Compute the deflection to the nearest 10 mils and range to the nearest 25 m. (IAW Chp 15, FM 23-91)

B. TASK: Compute a search mission.

CONDITION: Given an M16 plotting board, computer's record, a call-for-fire, and a tabular firing table.

STANDARD: Compute deflection to the nearest 10 mils and range to the nearest 25 m. (IAW Chp 15, FM 23-91)

C. TASK: Determine the firing data for an illuminating/coordinated illuminating mission.

CONDITION: Given an M16 plotting board, a computer's record, a call-for-fire, and a tabular firing table.

STANDARD: For HE and illumination rounds, determine deflection to the nearest 10 mils. HE range to nearest 25 m and illumination range to 50 m; time setting to nearest 1/10 sec. (IAW Chp 13, FM 23-91)

D. TASK: Compute data for split section operation.

CONDITION: Given an M16 plotting board, a tabular firing table, computer's record, data sheet, and the location for two mortar positions.

STANDARD: Compute data for both mortars to the nearest 10 mils in deflection and 25 m in range. (IAW Chp 15, FM 23-91)

E. TASK: Compute data for simultaneous mission operation.

CONDITION: Given an M16 plotting board, a tabular firing table, two computer's records, data sheet, and the location of mortar positions.

STANDARD: Compute data for both missions to the nearest 10 mils in deflection and 25 m in range (IAW Chp 10, FM 23-91).

F. TASK: Determine firing data for final protective fire.

CONDITION: Given an M16 plotting board, a computer's record, a tabular firing table, a call-for-fire, and subsequent corrections.

STANDARD: Apply target attitude and the firing data for the section or adjusting mortar to the nearest 10 mils in deflection and 25 m in range. (IAW Chp 13, FM 23-91; Chp 6, FM 6-30)

G. TASK: Compute an immediate/quick smoke mission.

CONDITION: Given an M16 plotting board, a computer's record, a tabular firing table, and a call-for-fire.

STANDARD: Compute the firing data for the section to the nearest 10 mils in deflection and 25 m in range. (IAW Chp 13, FM 23-91; Chp 6, FM 6-30)

III. ADVANCE ASSIGNMENT: Review FM 23-91, Chapters 10, 13, 14, and 15; review FM 6-30, Chapter 6.

IV. INTRODUCTION:

A. Gain Attention: Throughout history, commanders have used artillery for their indirect fire support. However, recent studies indicate that on future battlefields, artillery will be engaged as much as 80 percent of the time with counter-battery and other priority missions. This means you, the mortarmen of the future, must be prepared to fill this void.

B. Orient Students:

1. Lesson Tie-in: All of your previous training has to do with mechanical training or forward observer (FO) duties, followed by basic 81mm mortar FDC procedures. Now you will go a step further with more advanced 81mm mortar FDC procedures.

2. Motivation: As mortarmen, the procedures taught during this instruction are imperative if you are to insure fast, accurate mortar fire.

3. Scope: During this instruction, you will receive instruction on these subjects.

NOTE: SHOW VU-GRAPH #36 (FDC Advanced Training Tasks)

1. Explain the subjects that will be taught in advanced 81mm mortar FDC procedures.

NOTE: VU-GRAPH #36 OFF

2. Explain local classroom procedures as needed.

QUESTION: ASK FOR AND ANSWER ANY QUESTIONS.

V. BODY:

A. TASK: Compute a traverse mission.

CONDITION: Given an M16 plotting board, computer's record, a call-for-fire, and a tabular firing table.

STANDARD: Compute the deflection to the nearest 10 mils and range to the nearest 25 m. (IAW Chp 15, FM 23-91)

TRANSITION: Targets that are wider than the front of the section's parallel sheaf (150 m) are normally assigned to the mortar section because they require large amounts of ammunition. However, targets as wide as 450 m can be engaged when necessary by traversing fire.

1. To engage a target of this nature, the FDC should know the dimensions of the target in meters and the target attitude. This information is received in the call-for-fire.

2. Traversing fire is accomplisned by dividing the width of the target into equal segments for each mortar. Each mortar will traverse left or right depending on what the observer requests, or what the FDC decides.

3. The computer must remember to plot the mortars on the M16 plotting board by their attitude. Adjustment is made by the base mortar. This will be determined in the call-for-fire from the observer.

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

W27
A/F
GRID
005711
BOAT DOCK
300 x 50
ATT 0500

4. Once we record the call-for-fire, fill in the FDC order. Plot the target and determine the deflection, range, and initial azimuth. Now determine the heading and initial fire command. Data is determined by the parallel line method of plotting.

NOTE: VU-GRAPH #7 OFF

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board)

5. Plot the target and parallel the plot with the mortar.

NOTE: VU-GRAPH #10 OFF

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

QUESTIONS: WHAT IS THE INITIAL AZIMUTH, DEFLECTION, AND RANGE TO THE FIRST PLOT? (Int A-5320; Def-2530; Rng-3250) WHAT IS THE VI, RNG CORR, AND ANGLE T? (VI = -90; Rng Corr = -45; Angle T = 180)

6. Complete the heading. Determine and send the initial fire command to the guns.

SEC
HEQ
#2
1RD
2 WP & 2 PROX IN FEE
DEF 2530
CHG 6
ELV 0946

NOTE: VU-GRAPH #7 OFF

NOTE: REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record)

7. Record and compute observer's corrections to hit the target, and then determine the width of the target by attitude from flank to flank. (L50, -50 FFE)

NOTE: VU-GRAPH #8 OFF

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board)

8. Index the target attitude (0500) and from the adjusting point center mass of the target, plot one-half of the target width above center mass and one-half below. This will be the left and right flank of the target.

NOTE: Give students a 10-minute break.

9. Once you mark the width of the target, to determine the starting point for each gun, you must divide the width of the target by the number of guns used to fire for effect. These plots are made based on the direction of traverse. Parallel each mortar with its assigned plot to determine firing data. Index the attitude (0510) of the mortar section from the plot of the mortar (#2 gun). Go up 40 m and down 40 m from that mortar location. Then label your guns (1/2/3).

NOTE: VU-GRAPH #10 OFF

NOTE: REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record)

10. Determine subsequent commands for the fire for effect. (Prepare to traverse left; set 2 WP - 2 PROX, traverse left 1 turn, #1 DEF 2513, #2 DEF 2530, #3 DEF 2551 - ELV 0958). EOM, 6 Boats Burning, EST 5090 CAS.

NOTE: VU-GRAPH #8 OFF

NOTE: REPEAT VU-GRAPH #20 (Deflection Conversion Table) AND EXPLAIN mil RELATION FORMULA.

a. The computer determines the number of turns by dividing the number of intervals (one less than the number of rounds; i.e., 4 rounds = 3 intervals) into the width of the target in turns. Width of the target in turns is the segment one gun will traverse in meters.

b. Width of the target is 300 m, divided by number of mortars (3) = 100 m per gun. Range to the target is 3225 m. Round off the range to the nearest 100 m. Enter the D/C table at 3200 m and 100 m per mortar and determine number of mils (32).

c. One turn of traverse equals 10 m. Divide 10 into 32 mils (3.2) to determine the number of turns. Round of to the nearest whole turn (3).

d. To determine the number of turns between rounds, divide the total turns (3) by the intervals between rounds (3). Intervals between rounds is always one (1) less than the number of rounds to be fired. Turns are rounded to the nearest 1/2 turn.

NOTE: VU-GRAPH #20 OFF

QUESTION: WHAT ARE YOUR QUESTIONS PERTAINING TO TRAVERSING FIRE?

NOTE: Give students stretch break.

TRANSITION: Now that we have fired a target in width, we will fire a target in depth.

B. TASK: Compute a search mission.

CONDITION: Given an M16 plotting board, computer's record, a call-for-fire, and a tabular firing table.

STANDARD: Compute deflection to the nearest 10 mils and range to the nearest 25 m. (IAW Chp 15, FM 23-91)

1. Attacking targets more than 100 m in depth may be covered by searching fire. The method of distributing fire over a target in depth is the same as that employed in delivering traversing fire, except that the gunner elevates or depresses the elevating crank the number of turns determined in the fire command.

2. To engage a target of this nature, the FDC should know the dimensions of the target in meters and attitude. In the call-for-fire, the width and depth of the target (100 x 200) will come before the attitude (1900).

3. The observer should be within 100 m of the gun-target line and attitude should be parallel with the gun section. As a general rule, 4 rounds are used to cover 100 m.

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

W27
A/F SHIFT RP1
DIR 5130
R200, +300
UP 100
BN CP
100 x 200
ATT 1900

4. As we can see in the call-for-fire, the target size is 100 m x 200 m and we will have to search up. Therefore, the FFE will begin at the far edge of the target. Record the call-for-fire.

NOTE: Fill in FDC order.

NOTE: VU-GRAPH #7 OFF

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board)

5. Plot the target on your board. Now with the target plotted, we will always assume that the starting point is center mass unless otherwise specified by the observer. The target description and starting point for adjustment will determine which mortar or the number of mortars to adjust.

NOTE: VU-GRAPH #10 OFF

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

6. After the round is plotted and parallel with the guns, determine initial azimuth deflection and chart range.

QUESTION: WHAT IS THE INITIAL AZ? (5105) DEFLECTION? (2745) AND CHART RANGE? (3475) WHAT IS THE VI? (+50) RANGE CORR? (+25) AND ANGLE T? (30)

7. Complete the heading. Determine and send the initial fire command to the guns.

SEC
HEQ
#2
1RD
8 RDS PROX IN FFE
DEF 2745
CHG 7
ELV 0987

NOTE: VU-GRAPH #7 OFF

NOTE: REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record)

8. Record and compute the observer's correction to hit the target and determine a subsequent command for the guns to search. (L25, -50 FFE)

9. Show an example for computing turns.

a. Four rounds are fired to cover 100 m. Our target is 200 m in depth. Thus, it will take 8 rounds.

b. Enter firing table at chart range to final adjusting plot in column 4 to determine the number of turns per 100 m (range = 3400, turns = 3). Three (3) turns per 100 m = 6 turns per 200 m (target depth).

c. To determine the number of turns between rounds, divide intervals (7; one less than rounds) into turns (6 per 100 m) and round off to nearest 1/2 turn (6 divided by 7 = .8 = 1 turn).

10. Formulate the subsequent fire command and send it to the guns. Once you receive an EOM, update your equipment and data sheet.

NOTE: VU-GRAPH #8 OFF

QUESTION: WHAT ARE YOUR QUESTIONS PERTAINING TO A SEARCH MISSION?

NOTE: Give students a 10-minute break.

TRANSITION: Previously, we have computed only for targets seen by the observer during daylight hours. However, there may be times when you will be required to compute a mission to be fired during hours of darkness.

C. TASK: Determine the firing data for an illuminating/coordinated illuminating mission.

CONDITION: Given an M16 plotting board, a computer's record, a call-for-fire, and a tabular firing table.

STANDARD: For HE and illumination rounds, determine deflection to the nearest 10 mils. HE range to nearest 25 m and illumination range to 50 m; time setting to nearest 1/10 second. (IAW Chp 13, FM 23-91)

TRANSITION: Additional factors must be considered when computing a mission requiring illumination.

NOTE: Explain the material and information used to compute the mission.

1. FT 81-AI-3, Part II is used to determine charge, elevation, and time settings for illumination data.

2. The firing table for illumination is divided into several columns.

NOTE: SHOW VU-GRAPH #37 (Firing Table: Illumination Rounds)

NOTE: HAVE STUDENTS OPEN FT TO PAGE 169.

a. Column 1 - Range to burst - The horizontal distance measured from the gun to the burst point.

b. Column 2 - Elevation - The angle of the gun in the vertical plane that, used in conjunction with the fuze setting given in column 3, produces an air burst 600 m above the level point at a range given in column 1.

c. Column 3 - Fuze setting - Numbers to be set on fuze (M84A1) that, used in conjunction with the elevation given in column 2, will produce an air burst 600 m above the level point at the range given in column 1.

d. Columns 4 & 5 - Change in elevation and fuze setting for an increase of 50 m in height of burst - The changes in columns 4 and 5 must be applied simultaneously to increase the height without changing the range.

e. Column 6 - Maximum ordinate - The maximum height above the gun of the trajectory fired under standard conditions to the range in Column 1.

f. Column 7 - Range-to-impact - The horizontal distance from the gun to the point at which a non-functioning projectile will impact.

3. Assume that we are firing charge 6, at a range of 2000 m.

a. Move across the page at the range and determine elevation (1112) and fuze setting (26.8).

QUESTION: IF THE ROUND FAILS TO FUNCTION, WHERE WILL IT IMPACT? (2275 m)

b. The distance the cannister travels after the round functions is not determined; therefore, we should never plot an area to be illuminated over friendly forces.

NOTE: VU-GRAPH #37 OFF

4. Suppose the range to the target is 2100 m. To determine the charge, elevation, and fuze setting:

a. Enter the firing table on page XXXIX to determine the lowest charge to use. (charge 6)

b. Enter table at charge 6 for range 2100. Determine elevation from column 2 (1067) and fuze setting from column 3 (25.9).

c. This data will cause the round to illuminate burst 600 m over the target area on the same horizontal plane as the gun.

5. To determine a correction of down 100:

a. Enter table charge 6 at range 2100 and read columns 4 and 5.

b. We find that -18 mils in elevation and -0.8 tenths in fuze setting will increase the height of burst 50 m.

c. To make the correction of down 100, divide 100 by 50 (2). Multiply 2 x -18 (-36) and 2 x -0.8 (-1.6).

d. In order to decrease the height of burst, reverse the signs of the correction from columns 4 and 5 and apply the correction to the initial data for elevation and fuze setting.

Initial elevation	1067	Initial fuze setting	25.9
Elevation correction	+36	Fuse setting correction	+1.6
New elevation	1103	New fuze setting	27.5

QUESTION: FROM THE CORRECTION DOWN 100, WHAT IS THE ELEVATION AND FUZE SETTING WITH AN UP 150? (ELV 1049, -FZ 25.1)

NOTE: SHOW VU-GRAPH #38 (Illumination Cross)

6. An illumination cross is used to keep you oriented to where the round is in relation to the height of burst line.

7. When the illumination round is adjusted over the target, the observer may call for continuous illumination; in which case, a round will be fired every 60 seconds.

NOTE: VU-GRAPH #38 OFF

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

8. Record the call-for-fire on your computer's record and fill in the FDC order.

W27
A/F GRID 008703
VEHICLE NOISES
ILLUMINATION
OT DIR 5200

NOTE: VU-GRAPH #7 OFF

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board)

a. Plot the target on the board and parallel it with the gun to determine deflection and range.

NOTE: VU-GRAPH #10 OFF

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

b. Complete the heading and determine the initial fire command.

QUESTION: WHAT IS THE DEFLECTION? (2743) RANGE? (2650) AND CHARGE? (8)

#1
ILL
1RD
2743
CHG 8
TIME 30.4
ELV 1073

NOTE: VU-GRAPH #7 OFF; REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record)

c. Record and determine subsequent commands for the observer's corrections (R200 up 100 = DEF 2751; CHG 7; FZ 26.1; ELV 1010). The next correction was down 50 (FZ 26.9; ELV 1026). Only information which is changed in the subsequent command is recorded.

QUESTION: WHAT ARE YOUR QUESTIONS PERTAINING TO THE ILLUMINATING MISSION?

NOTE: VU-GRAPH #8 OFF

NOTE: Give students a 10-minute break.

9. After the illumination has been adjusted, the observer may call for HE using either continuous illumination, with a round fired every 60 seconds, or coordinated illumination.

a. Coordinated illumination is recommended because it helps conserve ammunition.

b. The illumination round is fired and time of flight is recorded until the observer gets the maximum illumination over the target and sends us "the mark."

NOTE: SHOW VU-GRAPH #39 (Illumination Mark)

c. Explain briefly.

NOTE: VU-GRAPH #39 OFF

NOTE: SHOW VU-GRAPH #40 (Coordinated Illumination)

d. Explain briefly.

NOTE: VU-GRAPH #40 OFF

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

W27
COOR ILL
A/F GRID 008703
EMY VEH
W/P in FFE
ALT 350
DIR 5200

10. Record the call-for-fire and fill in the FDC order.

NOTE: VU-GRAPH #7 OFF

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board)

a. Plot the target on your board and determine DEF (2743), INT AZ (3107), and RNG (2650).

NOTE: VU-GRAPH #10 OFF

NOTE: Give students a 10-minute break.

NOTE: REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record)

b. Record the observer's corrections and compute subsequent data for the HE rounds. 1st (L50 -50 = DEF 2762, ELV 1059; 19 seconds wait time) 2nd (R50 FFE = DEF 2741, ELV 1059; 19 seconds wait time).

11. After the observer sends an EOM, update your equipment and data sheets.

QUESTION: WHAT ARE YOUR QUESTIONS PERTAINING TO A COORDINATED ILLUMINATION MISSION?

NOTE: Give students a 10-minute break.

TRANSITION: Depending on the situation, your platoon leader may instruct you to split the section. One main reason is because of the effect of the counter-mortar radar. With the section in different locations, if one or two mortars become inoperative, some indirect fire support remains.

D. TASK: Compute data for split section operation.

CONDITION: Given an M16 plotting board, a tabular firing table, computer's record, data sheet, and the location for two mortar positions.

STANDARD: Compute data for both mortars to the nearest 10 mils in deflection and 25 m in range. (IAW Chp 15, FM 23-91)

TRANSITION: You have been instructed to move the #3 mortar to another location.

NOTE: REPEAT VU-GRAPH #9 (Data Sheet)

DDF 5200
MZ 5200 (RD0700)
GRID 03006910
MORT ALT 450
GRID INT 02/69

NOTE: HAVE STUDENTS TAKE OUT A DATA SHEET AND RECORD THE LOCATION FOR #3 GUN.

NOTE: ONCE #3 MORTAR IS IN LOCATION, YOU DETERMINE THE DOF FROM HIS LOCATION TO THE TGT (5200 mils).

NOTE: VU-GRAPH #9 OFF

1. While the #3 mortar was moving to another location, you received a call-for-fire.

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

W27
A/F GRID 013699
PLATOON IN OPEN
ALT 470
OT DIR 5460

2. Record the call-for-fire and complete the FDC order.

NOTE: VU-GRAPH #7 OFF

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board)

3. Plot the grid on your M16 plotting board and determine deflection, initial azimuth, and range.

NOTE: VU-GRAPH #10 OFF

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

4. Complete the heading and determine the initial fire command.

QUESTION: WHAT IS THE INITIAL AZIMUTH? (4996) DEFLECTION? (2854) RANGE? (2100) WHAT IS THE ANGLE T? (460)

NOTE: SEND INITIAL FIRE COMMAND TO THE GUNS.

NOTE: VU-GRAPH #7 OFF

NOTE: REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record)

5. Record the observer's corrections and determine subsequent commands for the guns. L50 +100 (DEF 2559, ELV 1024)

NOTE: VU-GRAPH #8 OFF

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board)

a. Make the observer's correction.

b. Correction +50 FFE (DEF 2849, ELV 1002).

c. You also have the #3 mortar plotted with a deflection scale of (0700) superimposed, so you determine a DEF (0665) and ELV (1101) from his position in order for the entire section to fire for effect on this target.

QUESTION: WHAT ARE YOUR QUESTIONS PERTAINING TO SPLIT SECTION OPERATION?

NOTE: VU-GRAPH #10 OFF

6. As always after each mission, we must update our equipment and data sheets.

NOTE: Give students a 10-minute break.

c. You also have the #3 mortar plotted with a deflection scale of (0700) superimposed, so you determine a DEF (0665) and ELV (1101) from his position on order for the entire section to fire for effect on this target.

QUESTION: WHAT ARE SOME OF YOUR QUESTIONS PERTAINING TO SPLIT SECTION OPERATION?

6. As always after each mission, we must update our equipment and data sheets.

NOTE: Give students a 10-minute break.

TRANSITION: When two or more missions are being computed as a simultaneous mission, the chief computer must check the location of each target to insure the mortars will not crossfire.

E. TASK: Compute data for a simultaneous mission.

CONDITION: Given an M16 plotting board, a tabular firing table, two computer's records, data sheet, and the location for mortar positions.

STANDARD: Compute data for both missions to the nearest 10 mils in deflection and 25 m in range (IAW Chp 10, FM 23-91).

TRANSITION: You have been instructed to set up your plotting board, moving all three mortars to the same location.

1. After setting up your M16 plotting board, you receive the first call-for-fire.

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

W27
A/F GRID
000695
ENY OP
W/COORD
ALT 500
OT DIR 4700

2. Record the call-for-fire and complete the FDC order.

NOTE: VU-GRAPH #7 OFF

3. Before you begin plotting, you receive a second call-for-fire.

NOTE: SHOW VU-GRAPH #41 (Top Half of Computer's Record: Copy II)

W28
A/F GRID
012707
SIO
ALT 460
OT DIR 5000

4. Record the call-for-fire and complete the FDC order.

NOTE: VU-GRAPH #41 OFF

TRANSITION: In this particular case, we have two missions to compute simultaneously. Since both targets are in the same area of operation, we will use the same deflection scale for both missions. Most importantly, at no time will we crossfire our mortars.

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board)

NOTE: PLOT BOTH GRIDS ON YOUR M16 PLOTTING BOARD AND DETERMINE DEFLECTIONS, INITIAL AZIMUTHS, AND RANGES TO TARGETS.

NOTE: VU-GRAPH #10 OFF

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

5. Complete the heading and determine the initial fire command for the first call-for-fire.

QUESTION: WHAT IS THE INITIAL AZIMUTH? (4641) DEFLECTION? (3059) AND RANGE? (3150) WHAT IS THE ANGLE T? (AT 260)

NOTE: SEND INITIAL FIRE COMMAND TO GUN #3.

NOTE: VU-GRAPH #7 OFF

TRANSITION: Before we receive a correction for the first mission, we determine the heading and the initial fire command for the second mission.

NOTE: REPEAT VU-GRAPH #41 (Top Half of Computer's Record: Copy II)

6. Complete the heading and determine the initial fire command for the second call-for-fire.

QUESTION: WHAT IS THE INITIAL AZIMUTH? (5156) DEFLECTION? (2544) AND RANGE? (2025) WHAT IS THE ANGLE T? (AT 160)

NOTE: SEND INITIAL FIRE COMMAND TO GUNS #1 & #2 .

NOTE: VU-GRAPH #41 OFF

TRANSITION: The following correction was received from the FO for Gun #3: R50 +50 FFE

NOTE: REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record)

7. Record the observer's correction and determine the subsequent command for gun #3.

NOTE: VU-GRAPH #8 OFF

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board)

NOTE: PLOT THE OBSERVER'S CORRECTION (DEF 3042, ELV 0958, CHART RNG 3175).

NOTE: VU-GRAPH #10 OFF

NOTE: REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record)

QUESTION: WHAT IS THE CHART DEF? (3042) AND CHART RNG? (3175)

NOTE: RECORD SUBSEQUENT FIRE COMMAND FOR THE FIRE FOR EFFECT AND SEND TO GUN #3.

TRANSITION: The following correction was received from the FO for Guns #1 and #2: L100 +100 FFE

NOTE: SHOW VU-GRAPH #42 (Bottom Half of Computer's Record. Copy II)

8. Record the observer's correction and determine the subsequent command for Guns #1 and #2.

NOTE: VU-GRAPH #2 OFF

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board)

NOTE: PLOT THE OBSERVER'S CORRECTION (DEF 2600, ELV 1061, CHART RNG 2125).

NOTE: VU-GRAPH #10 OFF

NOTE: REPEAT VU-GRAPH #42 (Bottom Half of Computer's Record: Copy II)

QUESTION: WHAT IS THE CHART DEFLECTION? (DEF 2600) AND CHART RNG? (2125)

NOTE: RECORD AND SEND SUBSEQUENT FIRE COMMAND FOR GUNS #1 AND #2.

NOTE: VU-GRAPH #42 OFF

NOTE: UPDATE BOTH TARGETS ON M16 PLOTTING BOARD AND UPDATE DATA SHEET.

QUESTION: WHAT ARE YOUR QUESTIONS PERTAINING TO A SIMULTANEOUS MISSION?

NOTE: Give students a 10-minute break.

TRANSITION: So far you have completed several types of missions, but the most important one is the final protective fire (FPF). During the next hour, you will learn how to compute a FPF mission.

F. TASK: Determine firing data for final protective fire.

CONDITION: Given an M16 plotting board, a computer's record, a tabular firing table, a call-for-fire, and subsequent corrections.

STANDARD: Apply target attitude and the firing data for the section or adjusting mortar to the nearest 10 mils in deflection and 25 m in range. (IAW Chp 13, FM 23-91; Chp 6, FM 6-30)

1. The FPF is the highest priority mission fired by a mortar section. FPF is a prearranged barrier of fire designed to protect friendly troops and installations by stopping enemy movement across defensive lines or areas. When the call for the FPF comes in, the section is ordered to fire until the alert is over or the ammunition is exhausted. Based on the weapon platoon leader's recommendation, the company commander assigns each mortar squad or entire section a FPF. The FPF should cover approaches into the company area not covered by heavier final protective fires.

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

W27
A/F GRID (MPFEBCAD) - ENCODED
(021697) - DECODED
ATT 0230
D/C HED IN ADJ S/L
ALT 480
OTP 5100

2. Use the creeping method of adjustment. Fuze delay is used on the adjusting rounds to further reduce danger. Unless the exact orientation of the sheaf is known by the observer, the entire section should fire one round so that he can choose the mortar nearest to its final position in the FPF (nearest to friendly troops) to adjust.

3. Record the call-for-fire and complete the FDC order.

NOTE: VU-GRAPH #7 OFF

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board)

4. Plot the target and determine the initial azimuth, deflection, and range.

NOTE: VU-GRAPH #10 OFF

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

5. Complete the heading and determine the initial fire command.

QUESTION: WHAT IS THE INITIAL AZ? (4509) DEF? (3191) RNG? (1050) VI (-20)? and ANGLE T? (590)

6. The initial fire command is sent to the mortars and the section fires the rounds. The observer watches the rounds impact to determine which mortar will be used to begin the adjustment.

NOTE: VU-GRAPH #7 OFF

NOTE: REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record)

7. The observer calls back: #1 R50 -25 (DEF 3170; RNG 1000; CHG 1; ELV 0928). The round is fired and the observer sends: #1 adjusted, repeat #2, #2 is fired with #1's data, #2 L50 (DEF 3215; RNG 1025; ELV 0867). #2 R20 adjusted, repeat #3. The correction is plotted and sent to #2 and #3 guns with #3 firing only. (DEF 3196; ELV 0867). After the #3 gun fires his rounds, the observer calls back: FPF adjusted.

NOTE: VU-GRAPH #8 OFF

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board) AFTER EACH FO CORRECTION

8. FPF is not given a coded name and data is kept at each gun after FPF is adjusted. This data will be placed on the guns at all times unless conducting another fire mission. It is desirable to have a certain number of rounds pre-cut at the adjusted FPF charge for almost instantaneous initiation of fires. The number of rounds pre-cut and set aside is based on the following considerations:

a. Unit SOP.

b. Availability of ammunition.

(1) Basic load.

(2) Ammunition on hand.

(3) Ammunition carried by the battalion.

c. Daily ammunition supply rate.

QUESTION: WHAT ARE YOUR QUESTIONS CONCERNING THE FPF?

NOTE: Give students a 10-minute break.

TRANSITION: We've fired missions thus far using HE and illumination ammunition. For the next two hours, we will show you how to compute for the WP ammunition.

G. TASK: Compute an immediate/quick smoke mission.

CONDITION: Given an M16 plotting board, a computer's record, a tabular firing table, and a call-for-fire.

STANDARD: Compute the firing data for the section to the nearest 10 mils in deflection and 25 m in range. (IAW Chp 13, FM 23-91; Chp 6, FM 6-30)

NOTE: SHOW VU-GRAPH #43 (Screening Mission)

1. There are two types of screening missions:

a. Smoke curtains (screens) are established between enemy and friendly units or installations to hamper observation, to reduce the effectiveness of hostile fire, to confuse hostile operations, and to deceive the enemy regarding friendly operations.

NOTE: VU-GRAPH #43 OFF

b. Blinding smoke is placed on the enemy positions to obscure enemy visual observation in friendly territory, and to produce casualties.

NOTE: SHOW VU-GRAPH #44 (Screening Mission: Three Requirements)

2. Generally, the platoon leader is given the mission of firing smoke through command channels. The primary consideration for planning a smoke screen is that it must accomplish its purpose without interfering with the activities of friendly troops. This requires considerable advance planning in the FDC. Authority to fire smoke missions rests with the highest commander whose troops will be affected. The flank unit commanders will be notified by the approving authority; however, the supported unit commanders must check with the commanders of flank units which will be affected to insure that they have been informed. The platoon leader directs and closely supervises the employment of smoke once he is authorized to fire the mission. The method he uses to accomplish the mission is not usually prescribed, but is developed by the chief computer and the FO who will adjust the mission. The decision on how to engage the target is based on:

a. Ammunition requirement. The number of rounds required to establish and maintain a screen is influenced by various factors. Most important is the size of the target and meteorological conditions affecting the dispersion of the smoke. Since the chief computer cannot accurately determine the weather conditions that will exist at the time the mission is fired, he determines the amount of ammunition for the most unfavorable conditions that might reasonably be expected.

b. Mortars required. Determined by the size of the area to be screened.

c. Casualty of blinding effects. If the smoke is to be placed directly on the target for blinding or casualty-producing effects, the observer adjusts the center of impact of the rounds onto the center of the target as with a destructive (HE) mission. The number of rounds per minute to produce this effect is twice that for a normal screening mission.

NOTE: VU-GRAPH #44 OFF

NOTE: SHOW VU-GRAPH #45 (Smoke Employment Considerations)

3. Explain slide.

NOTE: VU-GRAPH #45 OFF

NOTE: SHOW VU-GRAPH #46 (Factors Affecting Smoke Employment)

4. Explain slide.

NOTE: VU-GRAPH #46 OFF

NOTE: SHOW VU-GRAPH #47 (General Atmospheric Conditions and Effect on Smoke)

5. Explain slide.

NOTE: VU-GRAPH #47 OFF

NOTE: SHOW VU-GRAPH #48 (Number of WP Rounds per Minute Required to Maintain a Smoke Curtain on a 500 Meter Front in Flank Winds)

6. Explain slide.

NOTE: VU-GRAPH #48 OFF

NOTE: SHOW VU-GRAPH #49 (Quick Smoke: Three Phases)

7. A screening mission is conducted in three phases: First, the adjustment phase is conducted with HE ammunition. The upwind flank gun will adjust upwind of the target with HE. Once adjusted, one round of smoke is fired to see that it hits at the same location. Second, the screen is established by firing twice the number of rounds required to maintain the screen for one minute, or 10 rounds, whichever is greater. These rounds are fired as quickly as possible. Finally, the screen is maintained by firing a certain number of rounds per minute.

NOTE: VU-GRAPH #49 OFF

NOTE: REPEAT VU-GRAPH #48 (Number of WP Rounds per Minute Required to Maintain a Smoke Curtain on a 500 Meter Front in Flank Winds)

8. The smoke chart is used to compute the rate of fire necessary to maintain the screen. This chart is prepared for various weather conditions for a screen 500 m wide firing the 107mm mortars. Since we do not have a smoke card for the 81mm mortars, we use the same card. Other widths are computed by scaling values proportionately. To extract the proper value from the card, the chief computer must know the wind speed and direction, relative humidity, and temperature gradient (this tells whether the smoke will rise or linger on the battlefield). Wind speed and direction at ground level are reported in the MET message, but should be confirmed just before the round is fired. The other information may be obtained from MET data, BN S-2, instruments near the section, or estimation. The relative humidity (amount of moisture in the air) is rounded to the value nearest one of those on the table and the table amount is entered at that point. Temperature gradient is a measure of how air temperature changes with altitude. Lapse is the most common condition existing when air temperature decreases with increasing altitudes; neutral conditions exist when there is no appreciable temperature change with altitude; and inversion exists when the temperature rises with altitude (as in early morning).

The temperature gradient determines which line to use. The wind speed in knots determines which column to use. The point at which the proper row and column meet contains the number of rounds per minute needed to maintain a screen 500 m wide for one minute with a flank wind. For a wider or narrower screen, increase or decrease the number in the box proportionately. For a quartering (diagonal) wind, or a tail wind, multiply the value by two. For a head wind, multiply by two and one-half.

NOTE: DEMONSTRATE COMPUTING ROUNDS FOR SMOKE MISSION

#1 600 m front 55% inversion 7 knots 10 minutes

Crosswind:

600/500 x 3/1 = 18/5 = 3.3 = 4

1 adj
10 EST (15 seconds between rounds)
+40 maintain
51 total

#2 400 m front 80% neutral 10 knots 8 minutes

Crosswind:

400/500 x 3/1 = 12/5 = 2.4 = 3

1 adj
10 EST (20 seconds between rounds)
+24 maintain
35 total

9. Remember, in the establishing phase, never fire less than 10 rounds and round up to a whole number of rounds per gun.

10. The chief computer normally will have ample time to coordinate with the observer about the mission. The observer should, if possible, position himself within 100 m of the gun-target line.

QUESTION: WHAT ARE YOUR QUESTIONS PERTAINING TO SMOKE MISSIONS UP TO THIS POINT?

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record) INCLUDING AN APPROPRIATE CALL-FOR-FIRE.

11. Record the call-for-fire.

NOTE: VU-GRAPH #7 OFF

NOTE: GIVE INFORMATION TO COMPUTE AMMUNITION.

12. 300 m front 40% lapse 5 knots wind 6 minutes

3/5 x 13/1 = 39/5 = 7.4 = 8

1 adj
16 EST (8 seconds between rounds)
+48 maintain
65 total

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

13. Complete the FDC order.

NOTE: VU-GRAPH #7 OFF

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board)

14. Align the mortar and target using the parallel line method to determine deflection, initial azimuth, and range.

NOTE: VU-GRAPH #10 OFF

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

15. Complete the heading and determine the initial fire command.

QUESTION: WHAT IS THE INITIAL AZIMUTH, DEFLECTION, RANGE, VI, AND ANGLE T?

NOTE: SEND THE INITIAL FIRE COMMAND TO THE GUNS.

NOTE: VU-GRAPH #7 OFF

NOTE: Give students a 10-minute break.

NOTE: REPEAT VU-GRAPH #8 (Bottom Half of Computer's Record) INCLUDING APPROPRIATE OBSERVER CORRECTIONS.

16. Record observer's corrections and determine subsequent commands for the guns.

NOTE: VU-GRAPH #8 OFF

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board) AFTER EACH OBSERVER'S CORRECTION

17. Once the adjusting mortar is on target, the mortars fire a parallel sheaf in FFE. If the observer is within 100 m of the gun-target line, he can give corrections in turns to cover gaps. If a parallel sheaf does not effectively screen the target, the sheaf may be opened. The target width is divided equally between the three mortars and a starting point for each mortar A/O, and the data for each mortar is obtained by paralleling each mortar with its respective plot.

18. In the maintaining phase, the firing is controlled by the section leader or the senior squad leader.

19. Once you receive an EOM, update your equipment and data sheet.

QUESTION: WHAT ARE YOUR QUESTIONS PERTAINING TO A QUICK SMOKE MISSION?

TRANSITION: When immediate suppressive fires are ineffective because of inaccurate target location, immediate smoke can be used. The objective of immediate smoke is to obscure the enemy's vision and reduce his ability to observe.

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record) INCLUDING AN APPROPRIATE CALL-FOR-FIRE.

20. Record the call-for-fire and complete the FDC order. The number of rounds to fire in an immediate smoke mission is two WP rounds per gun.

NOTE: VU-GRAPH #7 OFF

NOTE: REPEAT VU-GRAPH #10 (M16 Plotting Board)

21. Plot the target on the M16 plotting board and determine deflection and range.

NOTE: VU-GRAPH #10 OFF

NOTE: REPEAT VU-GRAPH #7 (Top Half of Computer's Record)

22. Complete the heading and determine the initial fire command.

QUESTION: WHAT IS THE DEFLECTION AND RANGE?

a. The initial command is sent to the guns and they fire the rounds.

b. The observer gives EOM, area screened.

NOTE: VU-GRAPH #7 OFF

23. When firing an immediate smoke mission, you do not have to determine angle T unless the observer calls in a correction.

QUESTION: WHAT ARE YOUR QUESTIONS PERTAINING TO IMMEDIATE SMOKE?

24. Remember, smoke is very effective in helping you accomplish your mission, however, clearance must be obtained because it could also be effective against you.

VI. CONCLUSION:

A. Retain Attention: In order for you to provide the Infantry company with its own organic indirect fire support, you must be able to determine firing data for any type of mission requested by the FO. The lives of that Infantry company could depend on their indirect fire support.

B. Summary: During the past 14 hours, you have been taught how to compute the special mission procedures for the 81mm section.

C. Application: As an FDC computer, you must be able to adjust to any situation.

D. Closing Statement: The ability of the FDC to accept and compute accurate firing data for any type of mission requested by the forward observer will be a direct reflection on how well you perform.

APPENDIX C
LIST OF VU-GRAPHS

Number	Title	TASC Order Number
1.	FDC Basic Training Tasks	
2.	The Indirect Fire Team	TA 632-78A
3.	Infantry Company: 81mm Mortar Section Fire Direction Center	TA 632-78A
4.	Fire Direction Chief/Chief Computer	TA 632-78A
5.	Fire Direction Computer	TA 1799-82A
6.	Fire Direction RTO	TA 1799-82A
7.	Top Half of Computer's Record	TA 532-78A
8.	Bottom Half of Computer's Record	TA 532-78A
9.	Data Sheet	TA 532-78A
10.	M16 Plotting Board	TA 1162-83A
11.	Vernier Scale	TA 532-78A
12.	Magnified Portion of Rotating Disk	
13.	Types of Firing Charts	TA 632-78A
14.	Map Grid System	
15.	Charge vs. Range	TA 965-78A
16.	Firing Table: Charge 5	
17.	Determining Initial Data: Shift Mission	TA 1792-81A
18.	Angle "T"	TA 965-78A
19.	Converge Sheaf	
20.	Deflection Conversion Table	TA 965-78A
21.	Safety Diagram	TA 0206-83A
22.	Vertical Interval	TA 696-78A
23.	Determining Initial Data: Grid Mission	TA 096-79A
24.	Determining Initial Data: Polar Mission	TA 096-79A
25.	Standard Conditions	TA 779-78A
26.	Zone Height	TA 991-83A
27.	Ballistic MET Message 81mm	TA 0365-80A
28.	Ballistic MET Message: DA Form 3675	TA 693-79A
29.	Table D: Basic Data	
30.	Top Half of MET Data Correction Sheet for Mortars: DA Form 2601-1	TA 693-79A
31.	Table B: Temperature and Density Corrections	TA 693-79A
32.	Table A: Wind Components	TA 693-79A
33.	Table C: Propellant Temperature	TA 693-79A
34.	Table D: Correction Factors	TA 693-79A
35.	MET Cross	TA 0365-80A
36.	FDC Advanced Training Tasks	
37.	Firing Table: Illumination Rounds	
38.	Illumination Cross	TA 1878-81A
39.	Illumination Mark	TA 1541-78A
40.	Coordinated Illumination	TA 1541-78A
41.	Top Half of Computer's Record: Copy II	
42.	Bottom Half of Computer's Record: Copy II	
43.	Screening Mission	TA 606-78A
44.	Screening Mission: Three Requirements	TA 606-78A
45.	Smoke Employment Considerations	TA 606-78A
46.	Factors Affecting Smoke Employment	TA 606-78A
47.	General Atmospheric Conditions and Effect on Smoke	TA 606-78A
48.	Number of WP Rounds per Minute Required to Maintain a Smoke Curtain on a 500 Meter Front in Flank Winds	TA 606-78A
49.	Quick Smoke: Three Phases	TA 0365-80A

FDC BASIC TRAINING TASKS

A. FDC ORGANIZATION AND EQUIPMENT

B. OPERATE THE M16 PLOTTING BOARD

C. PREPARE OBSERVED FIRING CHARTS

D. PREPARE A MODIFIED OBSERVED FIRING CHART

E. PREPARE A SURVEYED FIRING CHART

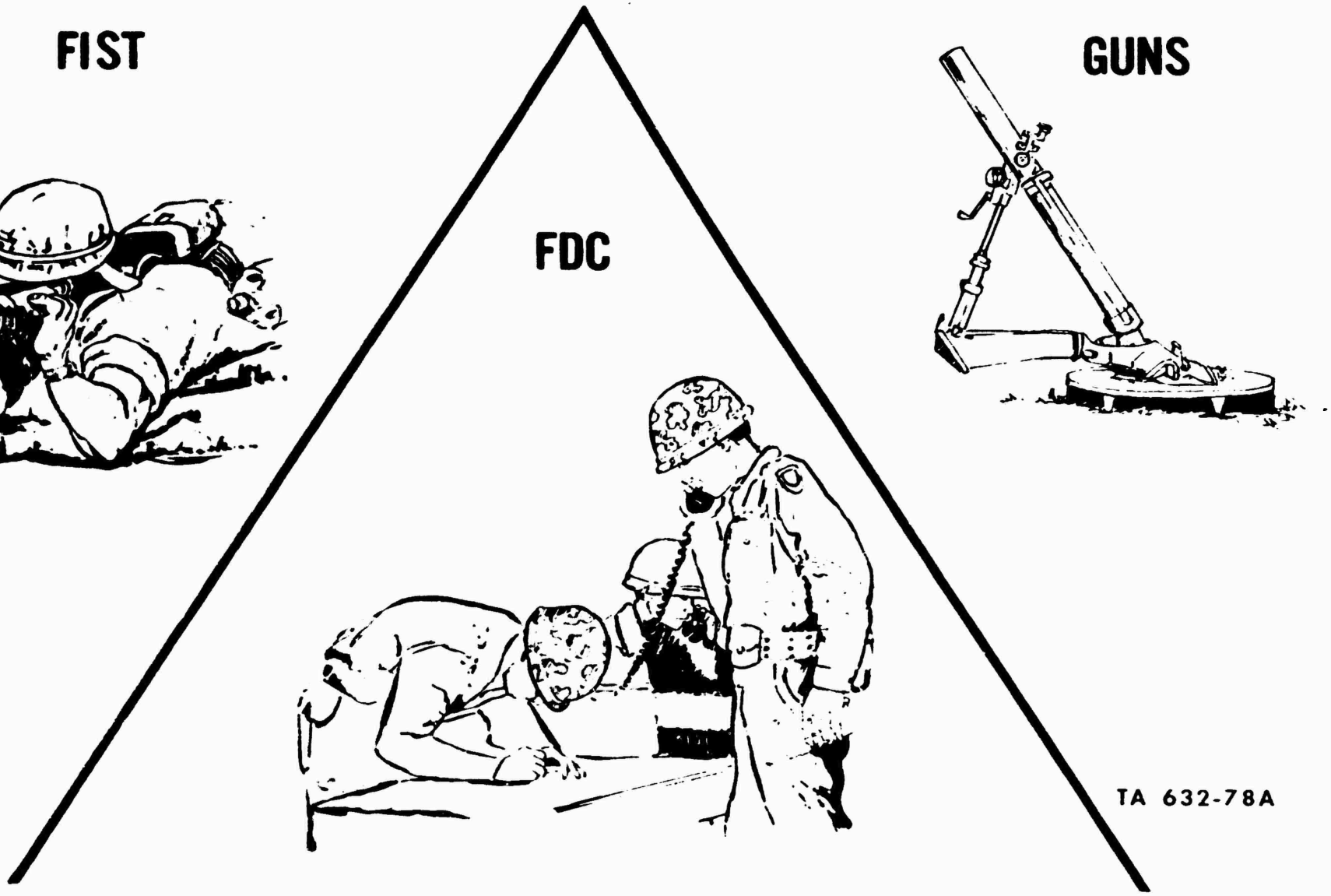
F. COMPUTE BASIC MISSIONS

G. SAFETY DIAGRAM PROCEDURES

H. USE OF DEFLECTION CONVERSION TABLES

I. DETERMINE AND APPLY METEOROLOGICAL CORRECTIONS

THE INDIRECT FIRE TEAM



INFANTRY COMPANY

[redacted]

MORTAR SECTION LEADER

COMPUTER

COMPUTER

RADIO TELEPHONE OPERATOR

TA 632-78A

FIRE DIRECTION CHIEF/CHIEF COMPUTER

- SUPERVISES AND TRAINS FDC
- MAKES DECISION TO FIRE
- ISSUES FDC ORDER
- VERIFIES CORRECTIONS AND COMMANDS
- DETERMINES TARGET ALTITUDE
- MAINTAINS RECORDS OF FIRE MISSIONS
- EVALUATES AND RELAYS INFORMATION
- COORDINATES WITH DIRECT SUPPORT ARTILLERY
- INSURES COMMUNICATIONS ARE ESTABLISHED
- MAINTAINS SITUATION MAP

FIRE DIRECTION COMPUTER

- OPERATES THE M–16 PLOTTING BOARD
- DETERMINES & ANNOUNCES DEF, CHG, & ELE
- DETERMINES ANGLE T
- REPLOT TARGETS FOR FUTURE REFERENCE
- POST INFORMATION ON THE M–16 PLOTTING BOARD
- MAINTAIN DATA SHEETS

TA 1799–82A

FIRE DIRECTION RTO

- INSTALLS WIRE
- REPEATS CALLS FOR FIRE FROM FO
- TRAINED IN THE DUTIES OF THE COMPUTER DRIVER

COMPUTER'S RECORD			
ORG	DATE	TIME	TGT NO
VI	CHG RG CORR	CHART DEFL	CHART RG
DEFL CORR		ANGLE T	CHG

CALL-FOR-FIRE	FDC ORDER	INITIAL FIRE COMMAND	RDS EXP
	MORT TO FFE _____ MORT TO ADJ _____ METH OF ADJ _____ BASIS FOR CORR _____ SHEAF CORR _____ SHELL-FUZE _____ _____ METHOD OF FFE _____ RG LATERAL SPREAD _____ ZONE _____ TIME OF OPENING FIRE _____	MORT TO FOLLOW _____ SHELL-FUZE _____ MORT TO FIRE _____ METHOD OF FIRE _____ _____ DEFLECTION _____ CHARGE _____ _____ _____ TIME SETTING _____ ELEVATION _____	

TA 532-78A

OBSERVER CORR			CHART DATA		SUBSEQUENT COMMANDS						
DEV	RG	(TIME) HEIGHT	DEFL	CHG (RG)	MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV	

AMMUNITION										
LOT NUMBER										
TYPE										
ON HAND										
RECEIVED										
TOTAL										
EXPENDED										
REMAINING										

TA 532-78A

DATA SHEET

ORGANIZATION _____ MORTAR GRID _____ MORTAR ALT _____ DATE _____

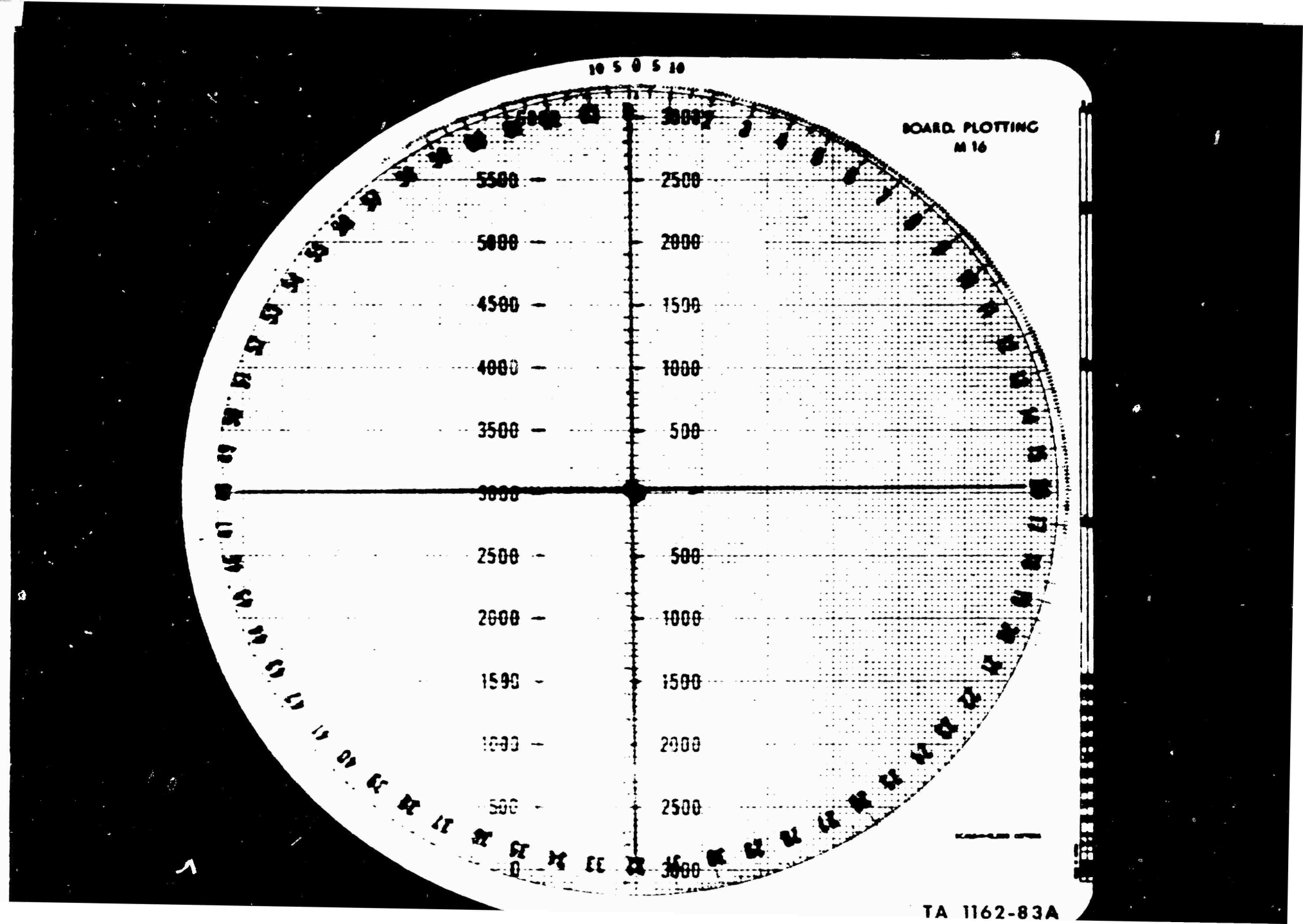
DIR OF FIRE _____ O.P.GRID 1 _____ O.P. ALT 1 _____ RCF _____

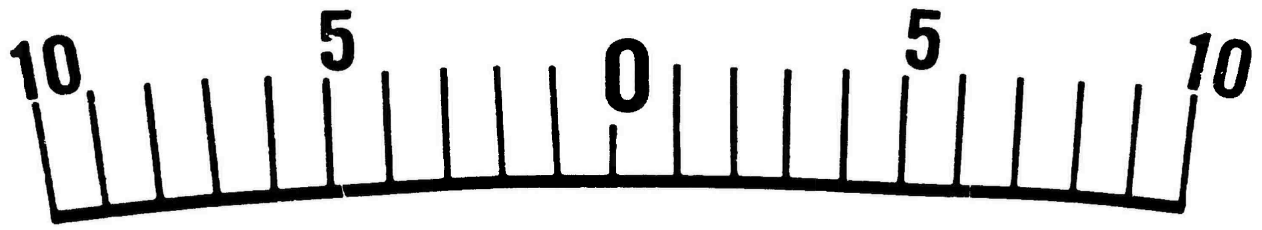
DRIFT _____ 2 _____ 2 _____ DEFL CORR _____

MOUNTING AZ _____ 3 _____ 3 _____ GRID INT _____

TARGET IDENT		CHART DATA		FIRING CORRECTIONS				FIRING DATA				INTELLIGENCE			
TGT NO	GRID	DEFL	RG / CHG	DEFL CORR	RG CORR	ALT VI	ALT CORR	DEFL	RG / CHG	FUZE TIME SET	ELEV	TIME FIRED	TARGET DESCR	METH OF ENGMT	SURVEIL-LANCE

TA 532-78A


10 5 0 5 10
BOARD PLOTTING
M 16
5500
5000
4500
4000
3500
2500
2000
1500
1000
500
2500
2000
1500
1000
500
2500
3000
TA 1162-83A


10
5
0
5
10

TYPES OF FIRING CHARTS

1. OBSERVED

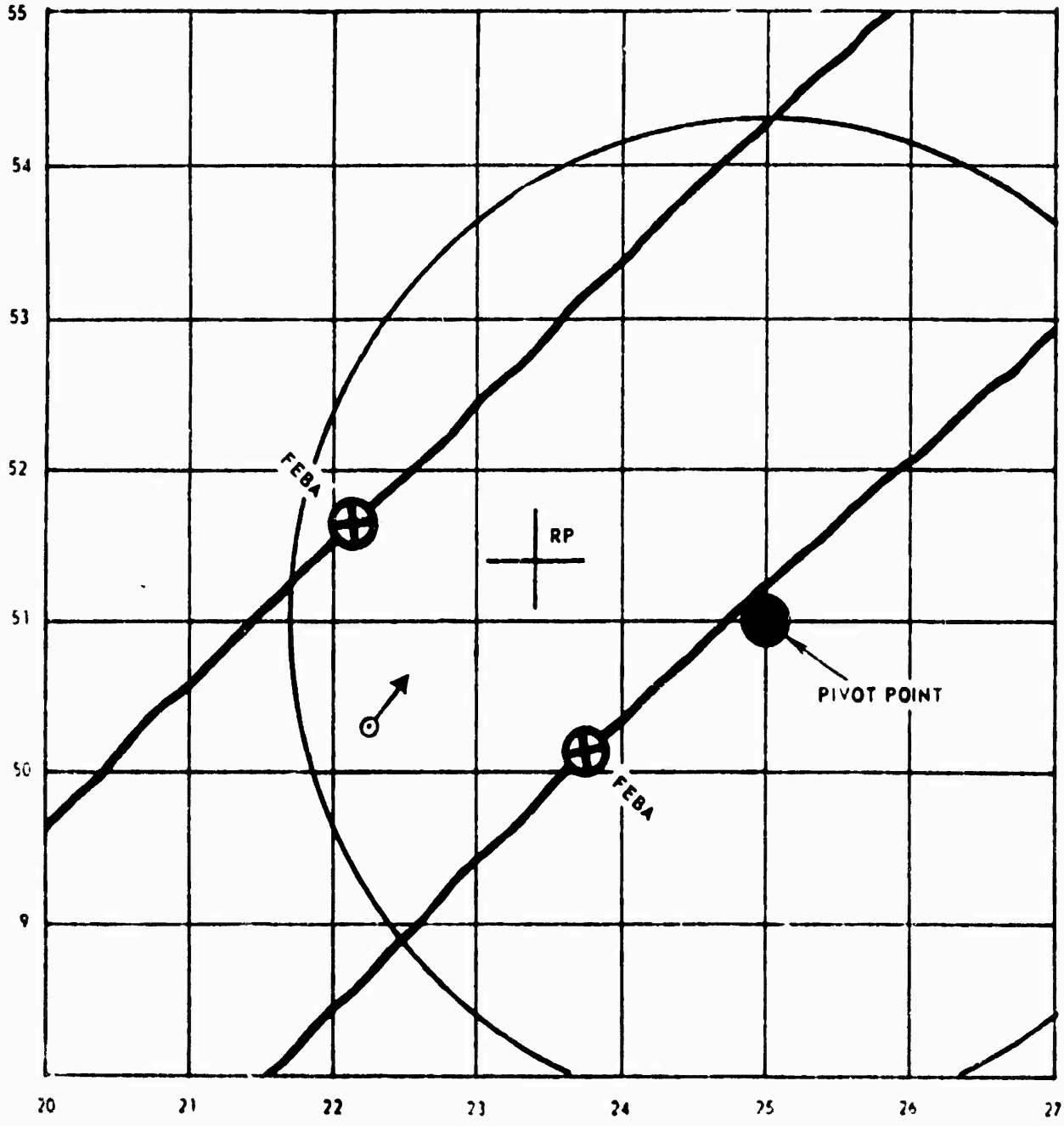
- DIRECTION
- DISTANCE

2. MODIFIED OBSERVED

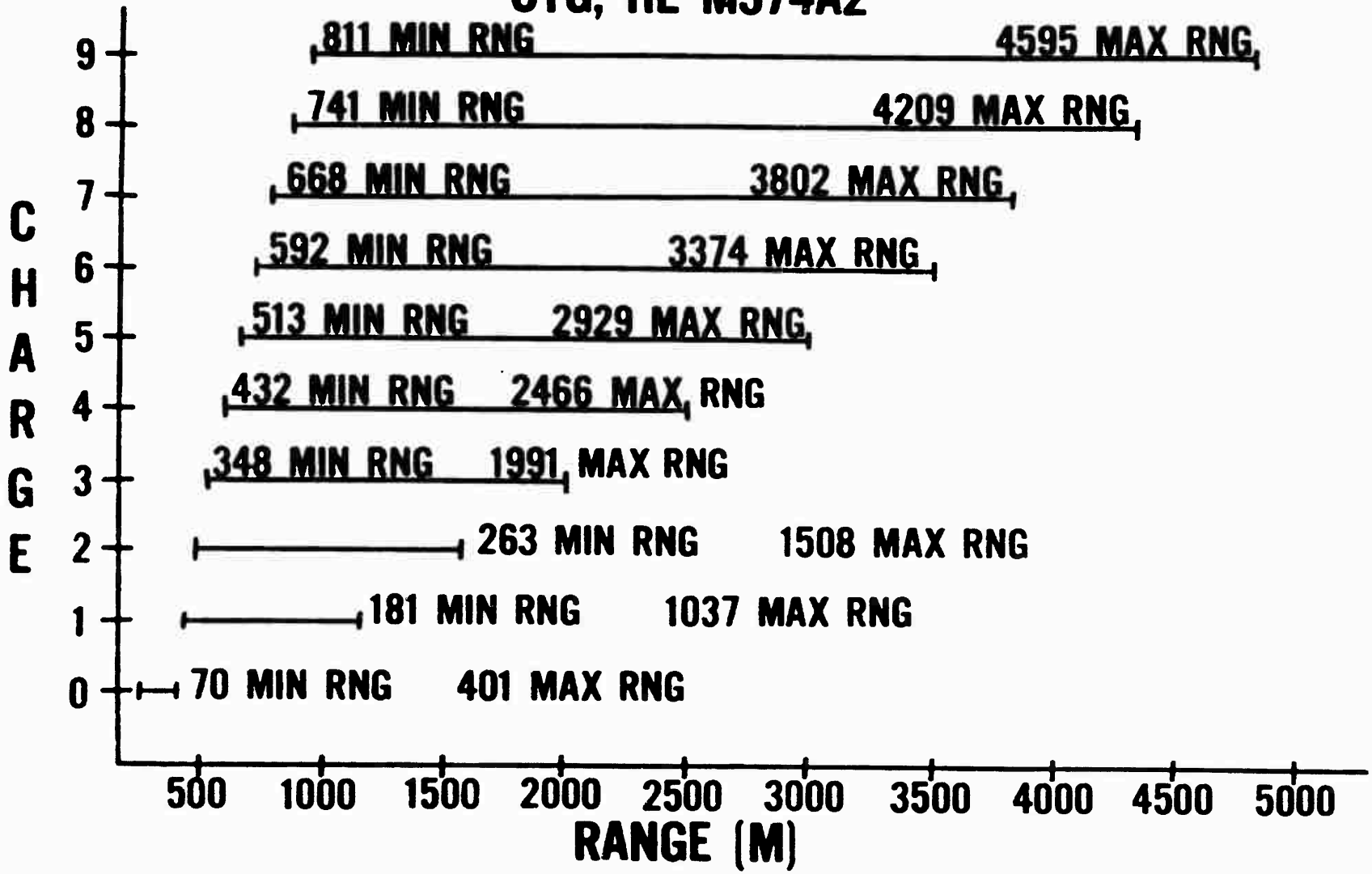
- GRID COORDINATE TO MORTARS OR TARGET

3. SURVEYED

- GRID COORDINATES TO BOTH THE MORTAR POSITION AND A REFERENCE POINT ARE KNOWN TO SURVEYED ACCURACY


55
54
53
52
51
50
9
20
21
22
23
24
25
26
27
FEBA
RP
PIVOT POINT
FEBA

CHARGE VS RANGE
CTG, HE M374A2



TA 965-78A

CHARGE 5

TABLE D

FT 81-AI-3

BASIC DATA

CTG, HE, M374A2
FUZE, PD, M567

1	2	3	4	5	6	7
RANGE	ELEV	D ELEV PER 100 M DR	APPROX NO. OF TURNS PER 100 M DR	LINE NO.	TIME OF FLIGHT	AZIMUTH CORRECTION CW OF 1 KNOT
M	MIL	MIL	NO.	NO.	SEC	MIL
2500	1068	35	4	3	31.6	1.2
2525	1059	36	4	3	31.4	1.2
2550	1050	37	4	3	31.2	1.2
2575	1041	39	4	3	31.1	1.1
2600	1031	40	4	3	30.9	1.1
2625	1021	42	4	3	30.7	1.1
2650	1010	43	4	3	30.5	1.1
2675	999	45	5	3	30.3	1.1
2700	988	48	5	3	30.1	1.1
2725	976	50	5	3	29.8	1.0
2750	963	54	5	3	29.6	1.0
2775	949	58	6	3	29.3	1.0
2800	934	63	6	3	29.0	1.0
2825	918	71	7	3	28.6	1.0
2850	899			3	28.2	0.9
2875	878			3	27.8	0.9
2900	852			3	27.2	0.9

DETERMINING INITIAL DATA
SHIFT MISSION

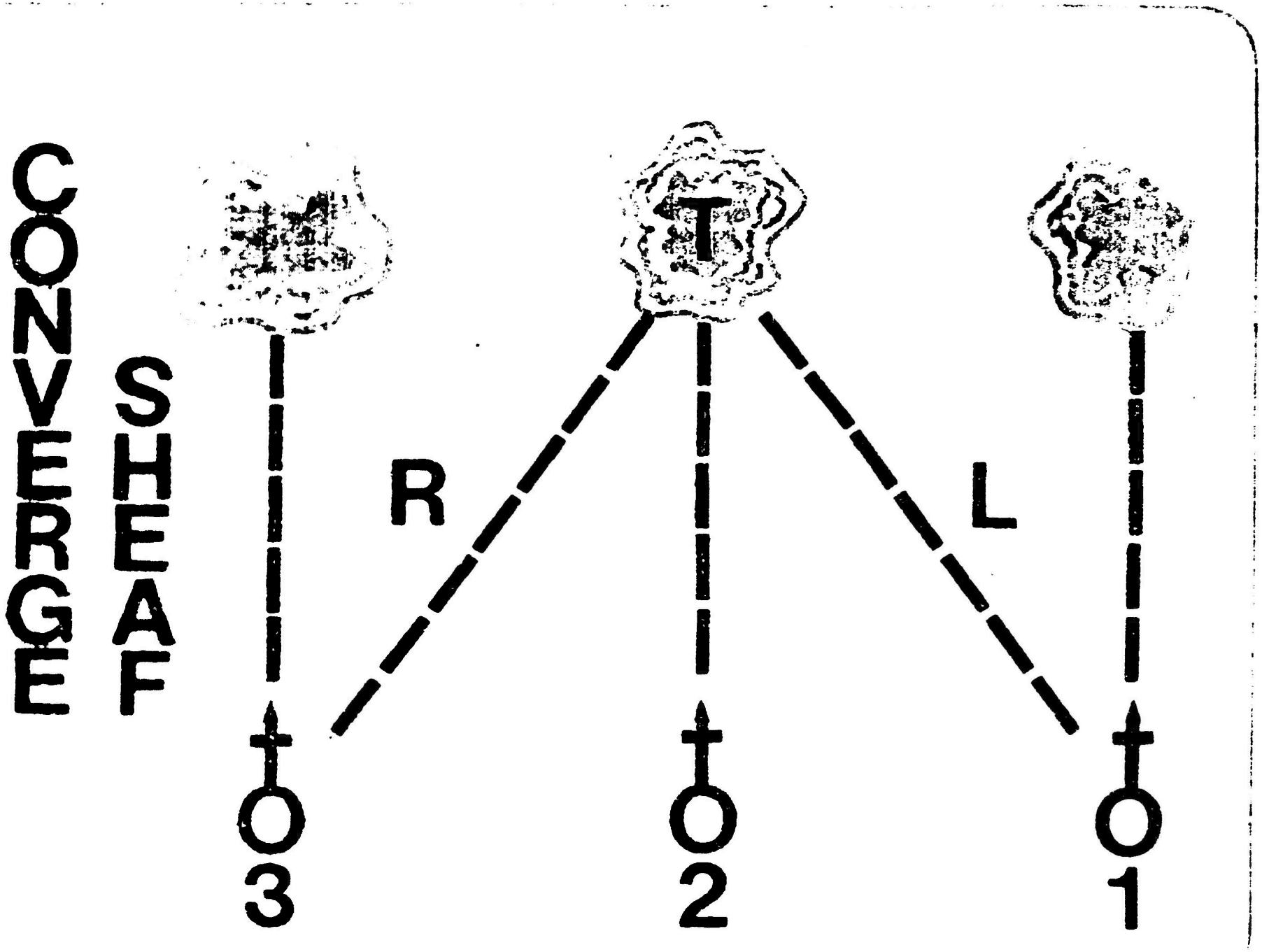
1. INDEX OBSERVERS DIRECTION
2. MAKE CORRECTIONS FROM KNOWN POINT
3. ROTATE AZIMUTH DISK UNTIL THE NEW PLOT IS OVER THE VERTICAL CENTER LINE
4. DETERMINE CHART DEFLECTION
5. DETERMINE CHART RANGE
6. INITIAL AZIMUTH

ANGLE "T"

ANGLE "T" IS DETERMINED TO THE NEAREST 1M, ROUNDED OFF TO THE NEAREST 10MS, AND ANNOUNCED TO THE NEAREST 100MS. WHEN ANGLE "T" IS 500MS OR GREATER, THE F O MUST BE INFORMED. ANGLE "T" CANNOT EXCEED 3200MS. IF IT DOES ADD 6400MS TO THE SMALLER NUMBER.

EXAMPLE:

	MT DIR. 6200	6400	6600	
	OT DIR. 0200	+0200	−6200	
EXCEEDS 3200MS	6000	6600		400M ANGLE "T"


CONVERGE
SHEAF
T
R
L
3
2
1

DEFLECTION CONVERSION TABLE

DEFLECTION IN MILS

RANGE IN METERS	DEFLECTION IN METERS														
	1	10	20	30	40	50	75	100	125	150	175	200	300	400	500
500	2.0	20	41	61	81	102	152	201	250	297	348	388	550	687	800
600	1.7	17	34	51	68	85	127	168	209	250	289	328	472	599	708
700	1.5	15	29	44	58	73	109	145	180	215	250	284	412	529	633
800	1.3	13	25	38	51	64	95	127	158	189	219	250	365	472	569
900	1.1	11	22	34	46	57	85	113	141	168	195	222	328	426	517
1000	1.0	10	20	31	41	51	76	102	127	152	176	201	297	388	473
1100	.93	9	18	28	37	46	69	92	116	138	161	183	271	355	435
1200	.85	8	17	25	34	42	64	85	106	127	148	168	249	328	402
1300	.79	8	16	23	31	39	59	78	98	117	136	155	231	304	374
1400	.73	7	15	22	29	36	55	73	91	109	127	145	215	283	349
1500	.68	7	14	20	27	34	51	68	85	102	118	135	201	265	328
1600	.63	6	13	19	25	32	48	64	80	95	111	127	189	250	309
1700	.60	6	12	18	24	30	45	60	75	90	104	119	178	235	291
1800	.57	6	11	17	23	28	42	57	71	85	99	113	168	223	276
1900	.54	5	11	16	21	27	40	54	67	80	94	107	160	211	262
2000	.51	5	10	15	20	25	38	51	64	76	89	102	152	201	250
2100	.49	5	10	15	19	24	36	48	61	73	85	97	145	192	238
2200	.46	5	9	14	19	23	35	46	58	69	81	92	138	183	228
2300	.44	4	9	13	18	22	33	44	55	66	77	88	132	175	218
2400	.43	4	8	13	17	21	32	42	53	63	74	85	127	168	209
2500	.41	4	8	12	16	20	31	41	51	61	71	81	122	162	201
2600	.39	4	8	12	16	20	29	39	49	59	68	78	117	155	194
2700	.38	4	8	11	15	19	28	38	47	57	66	75	113	150	187
2800	.37	4	7	11	15	18	27	36	45	55	64	73	109	145	180
2900	.35	4	7	11	14	18	26	35	44	53	61	70	105	140	174
3000	.34	3	7	10	14	17	25	34	42	51	59	68	102	135	168
3100	.33	3	7	10	13	16	25	33	41	49	57	66	98	131	163
3200	.32	3	6	10	13	16	24	32	40	48	56	64	95	127	158
3300	.31	3	6	9	12	15	23	31	39	46	54	62	92	123	153
3400	.30	3	6	9	12	15	22	30	37	45	52	60	90	119	149
3500	.30	3	6	9	12	15	22	29	36	44	51	58	87	116	145
3600	.29	3	6	8	11	14	21	28	35	42	49	57	85	113	141
3700	.28	3	6	8	11	14	21	28	34	41	48	55	82	110	137
3800	.27	3	5	8	11	13	20	27	33	40	47	54	80	107	133
3900	.27	3	5	8	10	13	20	26	33	39	46	52	78	104	130
4000	.26	3	5	8	10	13	19	26	32	38	45	51	76	102	127

TA 965-78A

SAFETY DIAGRAM

MAX CHARGE _____

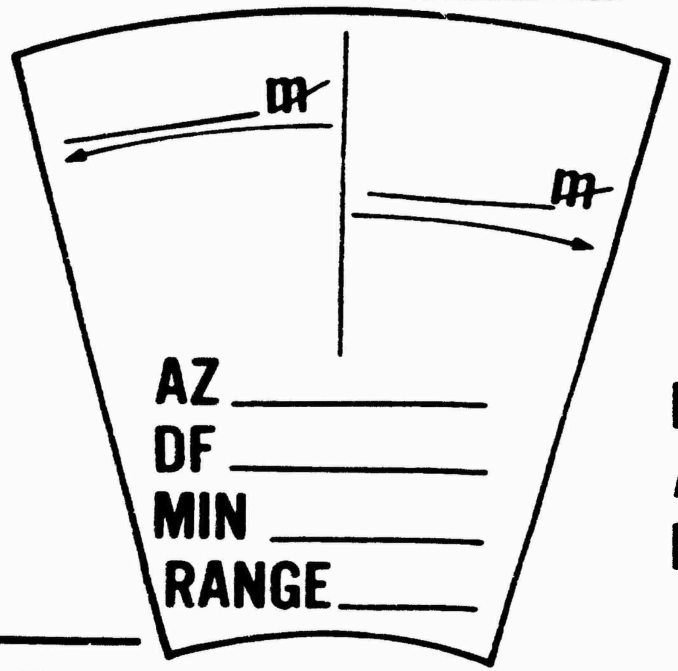
CHG MIN ELEV

— —————

— —————

81mm MORTAR & 107mm MORTAR
CIRCLE MORTAR FIRED

MAX RNG _____



LEFT LIMIT
AZ _____
DEF _____

RIGHT LIMIT
AZ _____
DEF _____

MIN CHG _____

CHG MAX ELEV _____

— —————

— —————

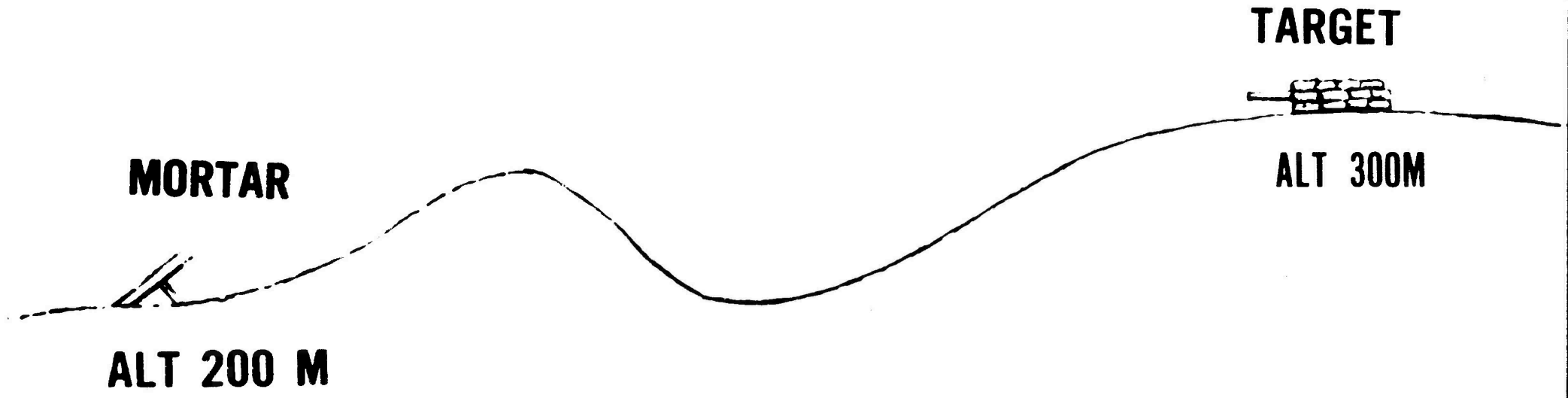
— —————

— —————

TA 206-83

VERTICAL INTERVAL

DIFFERENCE IN ALTITUDE BETWEEN THE MORTAR POSITION AND THE TARGET LOCATION



TA 696-78A

Determining Initial Data
Grid Mission

1. Orient plotting board to north '0'.
2. Plot grid coordinates.
3. Parallel plot with mortars.
4. Determine chart deflection.
5. Determine chart range.

Determining Initial Data
Polar Mission

1. Plot observers location.
2. Index observers direction.
3. Plot given distance from observers location.
4. Parallel plot with mortars.
5. Determine chart deflection.
6. Determine chart range.

STANDARD CONDITIONS

WEATHER

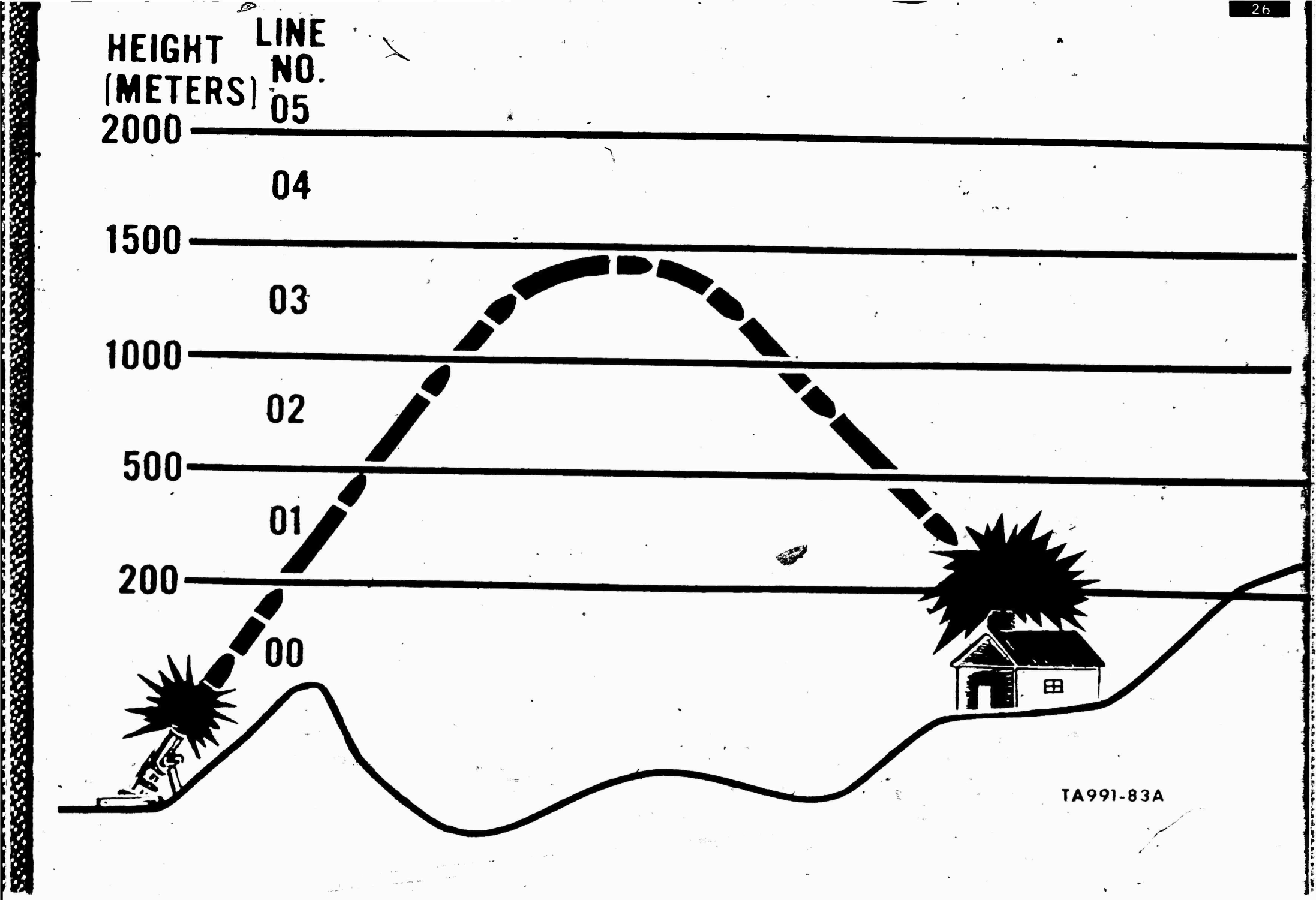
1. AIR TEMPERATURE 100 PERCENT (59°F)
2. AIR DENSITY 100 PERCENT (1225 GR/M)
3. NO WIND

POSITION

1. GUN AND TARGET AT SAME ALTITUDE
2. ACCURATE RANGE
3. NO ROTATION OF THE EARTH

MATERIAL

1. STANDARD WEAPON, PROJECTILE, AND FUZE
2. PROPELLANT TEMPERATURE 70°F
3. LEVEL TRUNIONS AND PRECISION SETTINGS
4. FIRING TABLE MUZZLE VELOCITY
5. NO DRIFT


HEIGHT (METERS)
LINE NO.
2000
05
04
1500
03
1000
02
500
01
200
00
TA991-83A

BALLISTIC MET MESSAGE 81 MM

METB31	344983
121450	037988
002109	029977
012205	029976
022318	033974
032419	039974
042620	039976
053123	050977
063123	050979

TA 0365-80A

BALLISTIC MET MESSAGE

IDENTIFICATION METB	TYPE MSG K	OCTANT Q	LOCATION $L_aL_aL_a$ $L_aL_aL_a$ OR OR XXX XXX	DATE YY	TIME (GMT) $G_cG_eG_e$	DURATION (HOURS) G	STATION HEIGHT (10'sM) hhh	MDP PRESSURE % OF STD PPP
METB								

ZONE HEIGHT (METERS)	LINE NUMBER ZZ	BALLISTIC WINDS		BALLISTIC AIR	
		DIRECTION (100'S MILS) dd	SPEED (KNOTS) FF	TEMPERATURE (% OF STD) TTT	DENSITY (% OF STD) ΔΔΔ
SURFACE	00				
200	01				
500	02				
1000	03				
1500	04				
2000	05				
3000	06				

TA 693-79A

CHARGE 6

TABLE D

FT 81-AI-3

BASIC DATA

CTG, HE, M374A2
FUZE, PD, M567

1	2	3	4	5	6	7
RANGE	ELEV	D ELEV PER 100 M DR	APPROX NO. OF TURNS PER 100 M DR	LINE NO.	TIME OF FLIGHT	AZIMUTH CORRECTION CW OF 1 KNOT
M	MIL	MIL	NO.	NO.	SEC	MIL
3000	1028	35	4	4	33.3	1.2
3025	1019	36	4	4	33.1	1.2
3050	1010	38	4	4	32.9	1.1
3075	1001	39	4	4	32.7	1.1
3100	991	41	4	4	32.5	1.1
3125	980	43	4	4	32.3	1.1
3150	969	45	4	4	32.1	1.1
3175	958	48	5	3	31.8	1.1
3200	946	51	5	3	31.6	1.0
3225	933	55	5	3	31.3	1.0
3250	919	60	6	3	31.0	1.0
3275	903			3	30.6	1.0
3300	886			3	30.2	1.0
3325	865			3	29.7	0.9
3350	839			3	29.0	0.9
3374	800			3	28.0	0.9

MET DATA CORRECTION SHEET FOR MORTARS (FM23-92 FORUSE)

COMMAND DATA		MET MESSAGE			
CHARGE RANGE	ELEVATION	TYPE	STATION	DATE	
ALT OF MORTARS (M)		TIME	ALT MDP	LINE NUMBER	
ALT OF MDP		WIND DIRECTION	WIND VELOCITY	AIR TEMP	AIR DENSITY
SECTION ABOVE + MDP Δ N BELOW −	+ −	Δ N CORRECTIONS		Δ T ±	Δ D ±
		CORRECTED VALUES			

WIND COMPONENTS AND DEFLECTION CORRECTION

WHEN DIRECTION OF WIND IS LESS THAN DIRECTION OF FIRE	6400
DIRECTION OF WIND	
DIRECTION FIRE	
CHART DIR OF WIND	

TA 693-79A

TABLE B

TEMPERATURE AND DENSITY CORRECTIONS

CORRECTIONS TO TEMPERATURE (BT) AND DENSITY (BD), IN PERCENT,
TO COMPENSATE FOR THE DIFFERENCE IN ALTITUDE,
IN METERS, BETWEEN THE BATTERY AND THE MDP

DH	0	+10-	+20-	+30-	+40-	+50-	+60-	+70-	+80-	+90-
0 BT	0.0	0.0	0.0	-0.1+	-0.1-	-0.1+	-0.1+	-0.2+	-0.2+	-0.2+
BD	0.0	-0.1+	-0.2+	-0.3+	-0.4-	-0.5-	-0.6+	-0.7+	-0.8+	-0.9+
+100-BT	-0.2+	-0.2-	-0.2+	-0.3+	-0.3-	-0.3-	-0.3-	-0.4+	-0.4+	-0.4+
BD	-1.0+	-1.1-	-1.2-	-1.3-	-1.4-	-1.5-	-1.6-	-1.7+	-1.8+	-1.9+
+200-BT	-0.5+	-0.5+	-0.5+	-0.6+	-0.6-	-0.6-	-0.6-	-0.7+	-0.7+	-0.7+
BD	-2.0+	-2.0-	-2.2-	-2.3-	-2.4-	-2.5-	-2.6+	-2.7+	-2.8+	-2.9+
+300-BT	-0.7+	-0.7+	-0.7+	-0.8+	-0.8-	-0.8-	-0.8-	-0.9+	-0.9+	-0.9+
BD	-3.0+	-3.1+	-3.2+	-3.3+	-3.4-	-3.5-	-3.6+	-3.7+	-3.8+	-3.9+

NOTES 1. DH IS BATTERY HEIGHT ABOVE OR BELOW THE MDP
2. IF ABOVE THE MDP, USE THE SIGN BEFORE THE NUMBER
3. IF BELOW THE MDP, USE THE SIGN AFTER THE NUMBER

TA 693-79A

TABLE A
WIND COMPONENTS

CHART DIRECTION OF WIND	CROSS WIND	RANGE WIND
MIL	KNOT	KNOT
1700	R .99	T .10
1800	R .98	T .20
1900	R .96	T .29
2000	R .92	T .38
2100	R .88	T .47
2200	R .83	T .56
2300	R .77	T .63
2400	R .71	T .71
2500	R .63	T .77
2600	R .56	T .83
2700	R .47	T .88
2800	R .38	T .92
2900	R .29	T .96
3000	R .20	T .98
3100	R .10	T .99
3200	0	T 1.00

CHART DIRECTION OF WIND	CROSS WIND	RANGE WIND
MIL	KNOT	KNOT
4900	L .99	H .10
5000	L .98	H .20
5100	L .96	H .29
5200	L .92	H .38
5300	L .88	H .47
5400	L .83	H .56
5500	L .77	H .63
5600	L .71	H .71
5700	L .63	H .77
5800	L .56	H .83
5900	L .47	H .88
6000	L .38	H .92
6100	L .29	H .96
6200	L .20	H .98
6300	L .10	H .99
6400	0	H 1.00

TA 693-79A

TABLE C

PROPELLANT TEMPERATURE

VARIATIONS IN MUZZLE VELOCITY DUE TO PROPELLANT TEMPERATURE

TEMPERATURE OF PROPELLANT	VARIATION IN VELOCITY	TEMPERATURE OF PROPELLANT
DEGREES F	MIS	DEGREES C
25	-2.7	-3.9
30	-2.4	-1.1
35	-2.1	1.7
40	-1.8	4.4
45	-1.5	7.2
50	-1.2	10.0
55	-0.9	12.8
60	-0.6	15.6
65	-0.3	18.3
70	0.0	21.1
75	0.3	23.9
80	0.5	26.7
85	0.8	29.4
90	1.1	32.2
95	1.3	35.0
100	1.5	37.8

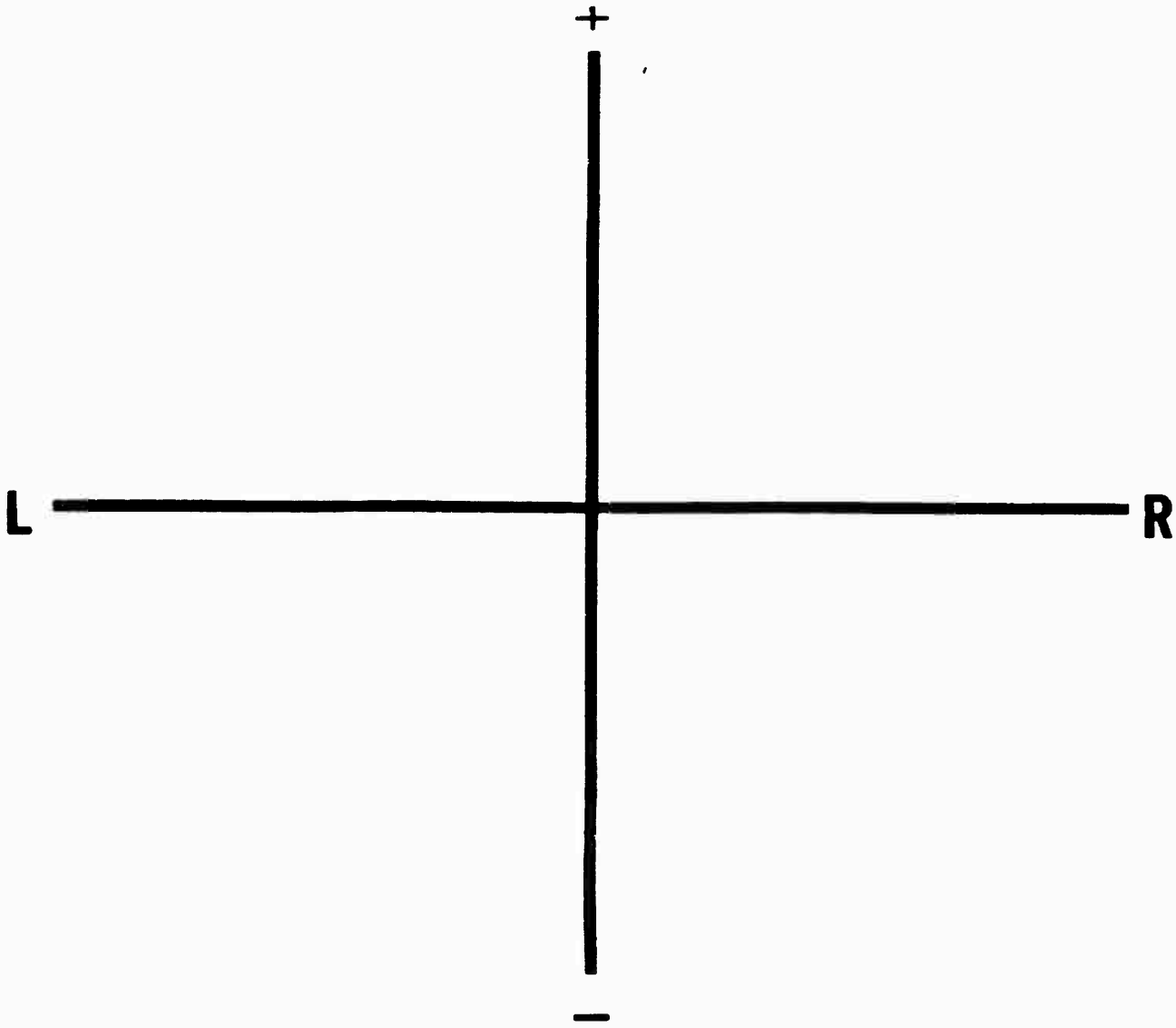
TA 693-79A

TABLE D
CORRECTION FACTORS

CHARGE 6

1	8	9	10	11	12	13	14	15
RANGE	RANGE CORRECTIONS FOR							
	MUZZLE VELOCITY 1 M/S		RANGE WIND 1 KNOT		AIR TEMP 1 PCT		AIR DENSITY 1 PCT	
	DEC	INC	HEAD	TAIL	DEC	INC	DEC	INC
M	M	M	M	M	M	M	M	M
3000	22.9	-19.9	5.5	-4.8	0.1	0.0	-7.9	7.8
3025	23.1	-20.1	5.4	-4.8	0.1	0.0	-8.0	7.9
3050	23.3	-20.3	5.4	-4.8	0.1	0.0	-8.0	7.9
3075	23.6	-20.4	5.3	-4.9	0.1	0.0	-8.1	8.0
3100	23.8	-20.6	5.2	-4.9	0.1	0.0	-8.2	8.1
3125	24.0	-20.8		-4.9	0.1	0.0	-8.2	8.1
3150		-20.9		-4.9	0.1	0.0	-8.3	8.2
3175		-21.1		-4.9	0.1	0.0	-8.3	8.2
3200		-21.3		-4.9	0.1	0.0	-8.4	8.2
3225		-21.4		-4.9	0.1	0.0	-8.5	8.2
3250		-21.6		-4.9	0.1	0.0	-8.5	8.3
3275		-21.8		-4.9	0.1	0.0	-8.6	8.3
3300		-21.9		-4.9	0.1	0.0	-8.6	
3325		-22.1		-5.0	0.2	0.0	-8.7	
3350		-22.3		-5.0	0.2	0.0	-8.7	
3374		-22.4		-5.0		0.0	-8.7	

TA 693-79A



TA 0365-80A

FDC ADVANCED TRAINING TASKS

A. COMPUTE A TRAVERSE MISSION

B. COMPUTE A SEARCH MISSION

C. DETERMINE FIRING DATA FOR ILLUMINATING MISSIONS

D. COMPUTE DATA FOR SPLIT SECTION OPERATION

E. COMPUTE DATA FOR SIMULTANEOUS MISSION OPERATION

F. DETERMINE FIRING DATA FOR FINAL PROTECTIVE FIRE

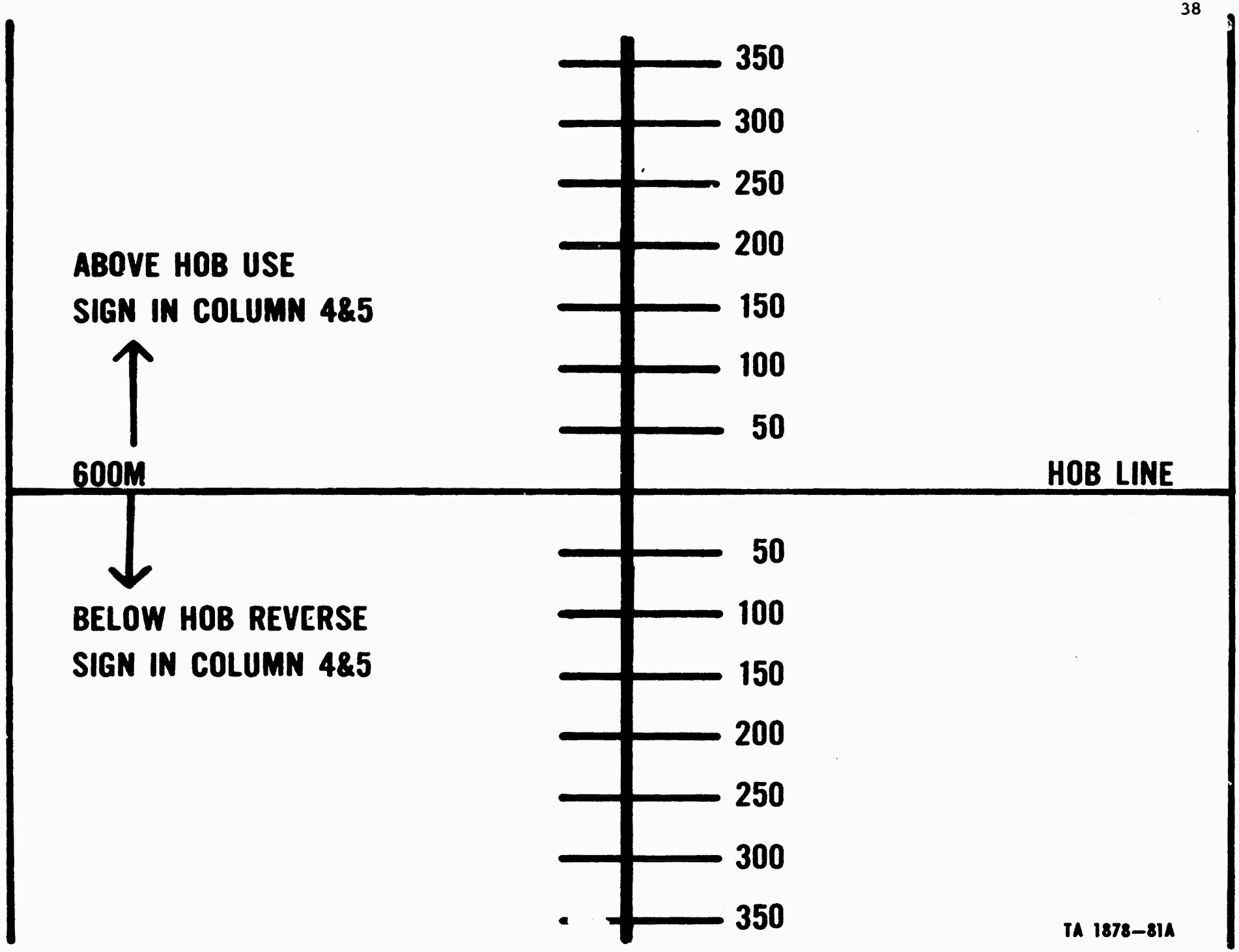
G. COMPUTE AN IMMEDIATE/QUICK SMOKE MISSION

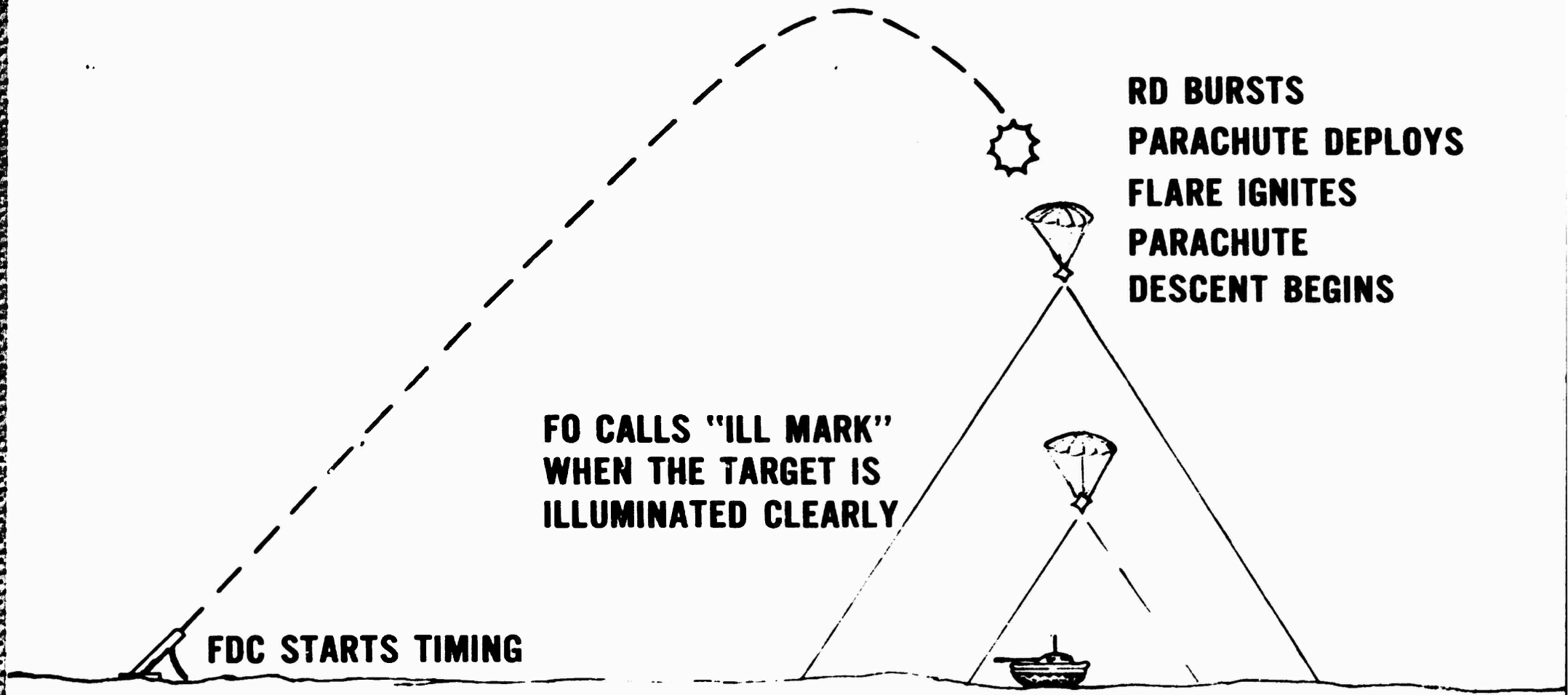
FT 81-AI-3

CHARGE 6

CTG, ILLUMINATING, M301A3
FUZE, TIME, M84A1

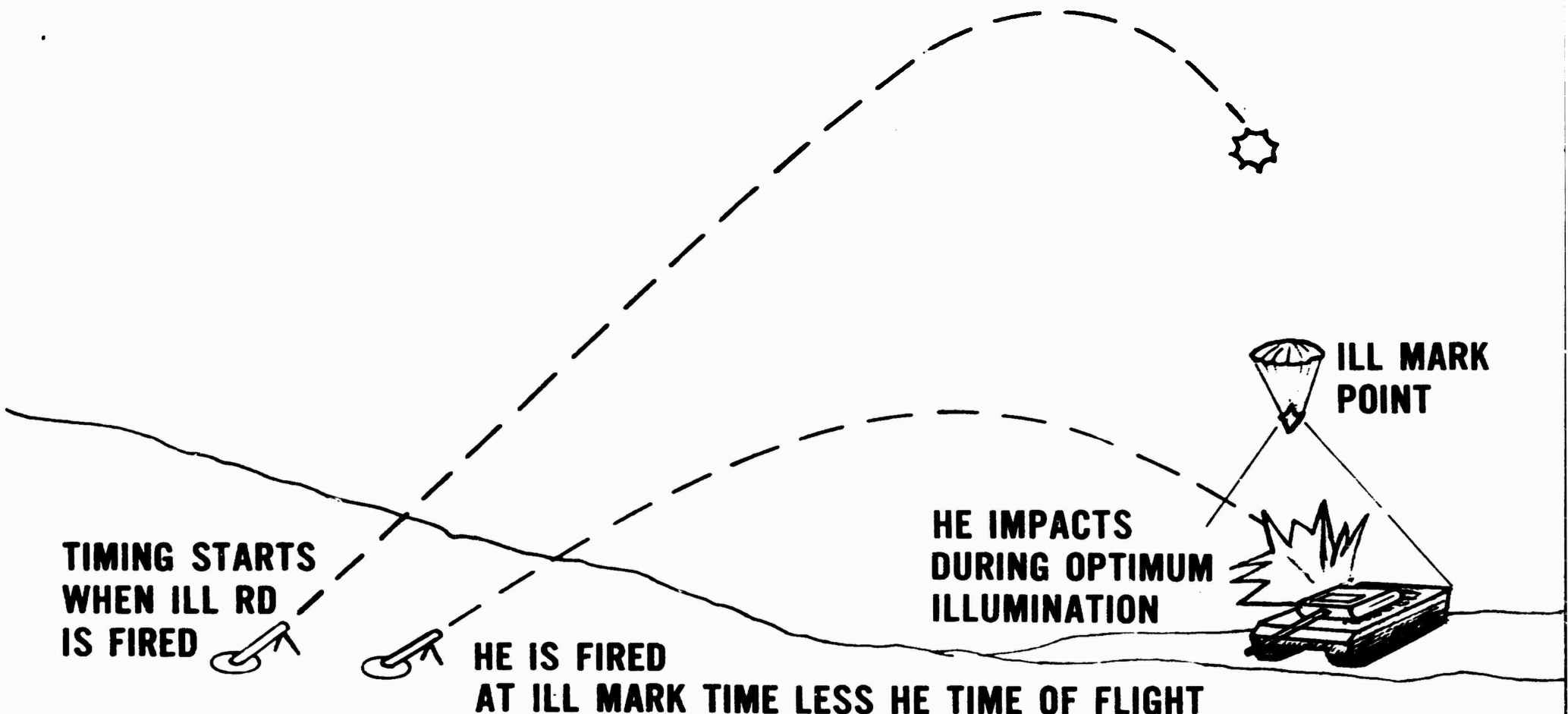
1	2	3	4	5	6	7
RANGE TO BURST	ELEV	FUZE SETTING	CHANGE IN ELEV FOR 50M INCREASE IN HEIGHT OF BURST	CHANGE IN FS FOR 50M INCREASE IN HEIGHT OF BURST	MAX ORD	RANGE TO IMPACT
M	MILS		MILS		M	M
1900	1151	27.4	-10	-0.6	1314	2149
1950	1132	27.1	-11	-0.6	1292	2212
2000	1112	26.8	-13	-0.7	1268	2275
2050	1090	26.4	-15	-0.7	1241	2340
2100	1067	25.9	-18	-0.8	1210	2407
2150	1040	25.4	-23	-1.0	1174	2478
2200	1007	24.7	-36	-1.3	1131	2554
2250	964	23.7			1070	2642


350
300
250
200
150
100
50
ABOVE HOB USE
SIGN IN COLUMN 4&5
600M
HOB LINE
50
100
150
200
250
300
350
BELOW HOB REVERSE
SIGN IN COLUMN 4&5
TA 1878—81A



NOTE THAT THE AREA ILLUMINATED GETS SMALLER AS THE ROUND DESCENDS HOWEVER, TARGETS WITHIN THE AREA RECEIVES MORE LIGHT.

TA 1541-78A


ILL MARK
POINT
HE IMPACTS
DURING OPTIMUM
ILLUMINATION
TIMING STARTS
WHEN ILL RD
IS FIRED
HE IS FIRED
AT ILL MARK TIME LESS HE TIME OF FLIGHT

TA 1541-78A

COMPUTER'S RECORD

ORG	DATE	TIME	TGT NO
VI	CHG RG CORR	CHART DEFL	CHART RG
DEFL CORR		ANGLE T	CHG

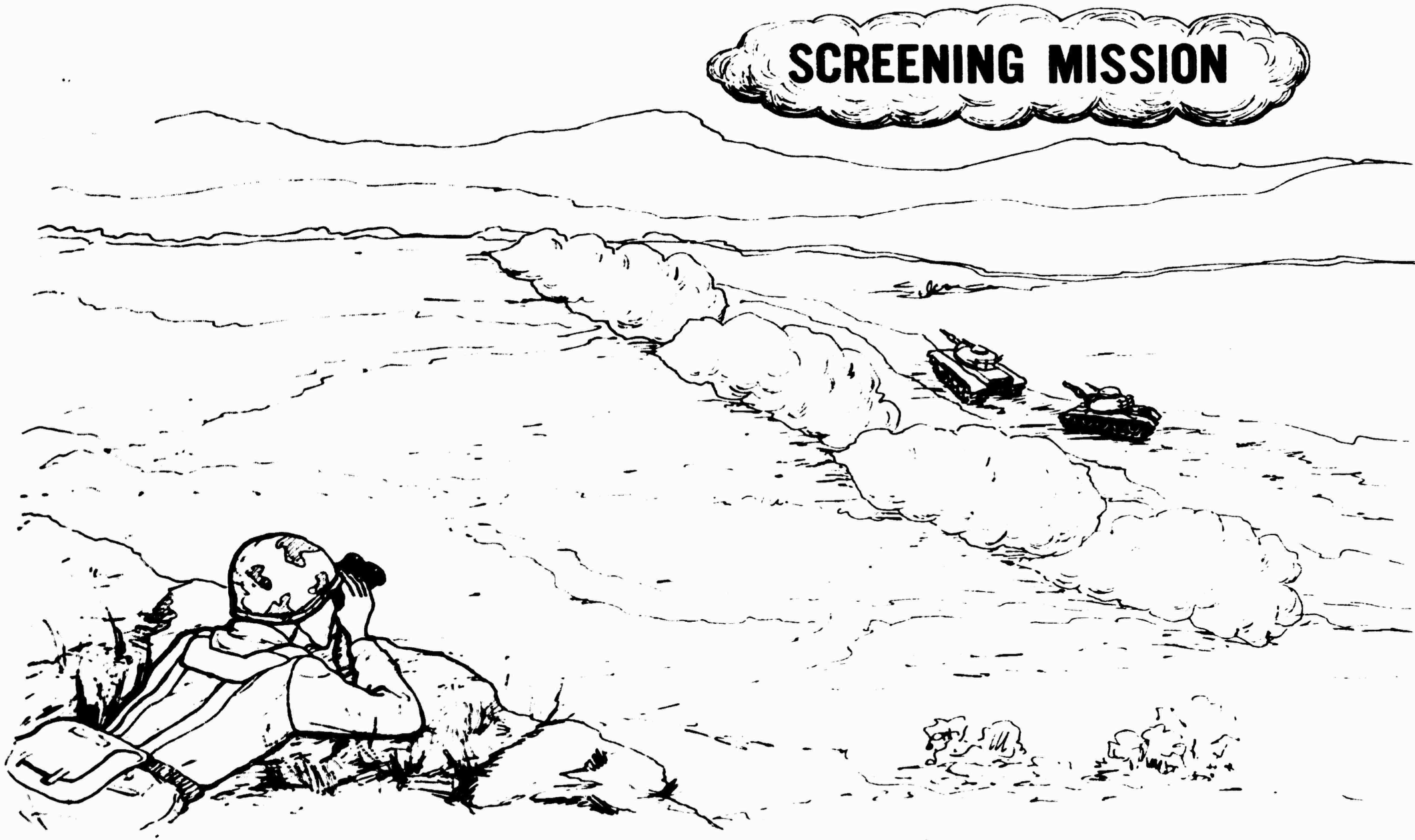
CALL-FOR-FIRE	FDC ORDER	INITIAL FIRE COMMAND	RDS EXP
	MORT TO FFE _____	MORT TO FOLLOW _____	
	MORT TO ADJ _____	SHELL-FUZE _____	
	METH OF ADJ _____	MORT TO FIRE _____	
	BASIS FOR CORR _____	METHOD OF FIRE _____	
	SHEAF CORR _____		
	SHELL-FUZE _____	DEFLECTION _____	
		CHARGE _____	
	METHOD OF FFE _____		
	RG LATERAL SPREAD _____		
	ZONE _____	TIME SETTING _____	
	TIME OF OPENING FIRE _____	ELEVATION _____	

TA 532-78A

OBSERVER CORR			CHART DATA		SUBSEQUENT COMMANDS						
DEV	RG	(TIME) HEIGHT	DEFL	CHG (RG)	MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV	

AMMUNITION										
LOT NUMBER										
TYPE										
ON HAND										
RECEIVED										
TOTAL										
EXPENDED										
REMAINING										

TA 532-78A



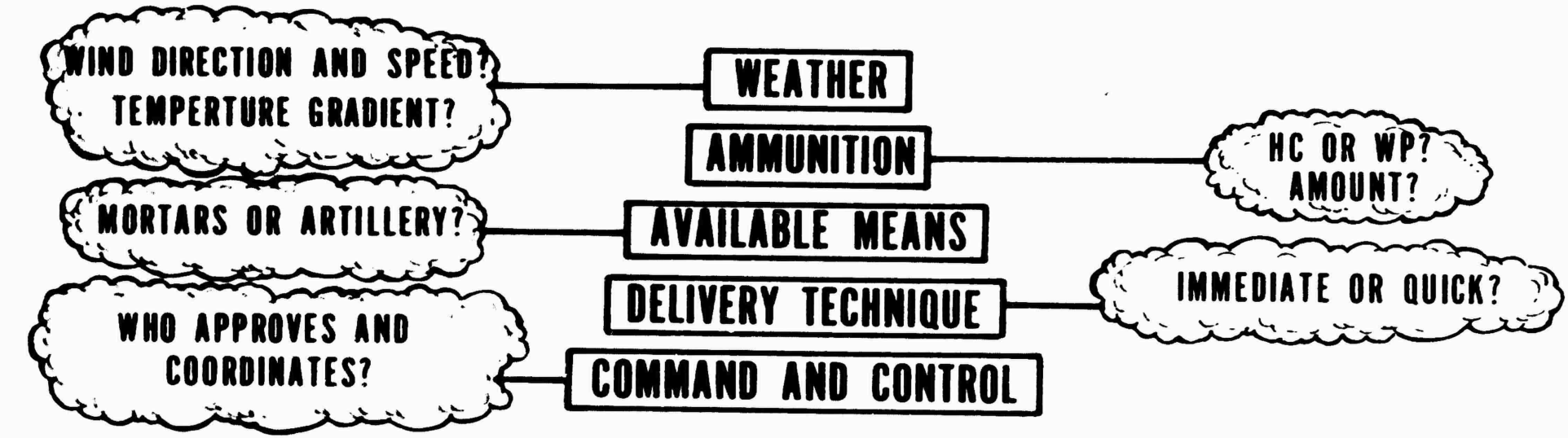
TA 606-78A

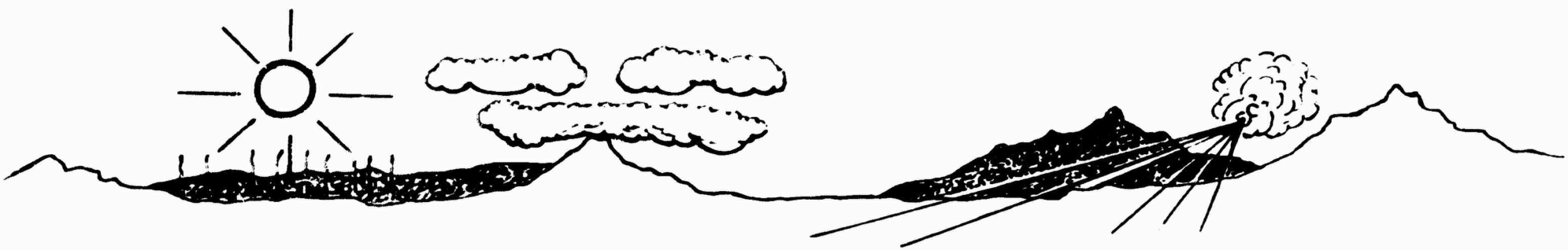
SCREENING MISSION

- PREPLANNED
- REQUIRES AUTHORIZATION
- REQUIRES ADDITIONAL AMMUNITION

TA 606-78A

SMOKE EMPLOYMENT CONSIDERATIONS





ATMOSPHERIC STABILITY

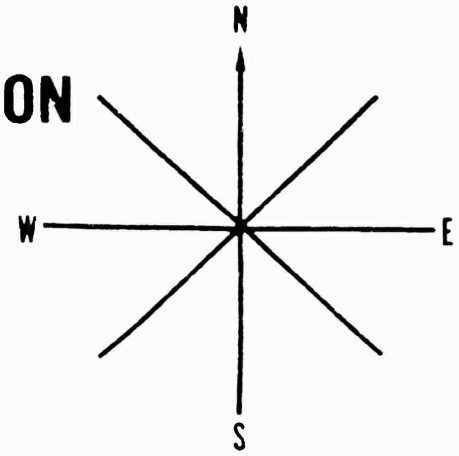
WIND DIRECTION AND SPEED

TA 606-78A

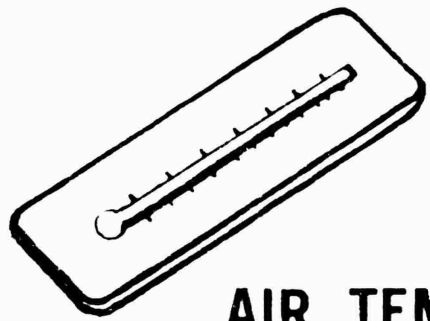
FACTORS AFFECTING SMOKE EMPLOYMENT

WIND SPEED

WIND DIRECTION



HUMIDITY AND PRECIPITATION



AIR TEMPERATURE

TA 606-78A

WIND SPEED?
WIND DIRECTION?
CLOSEST
TIME OF DAY?

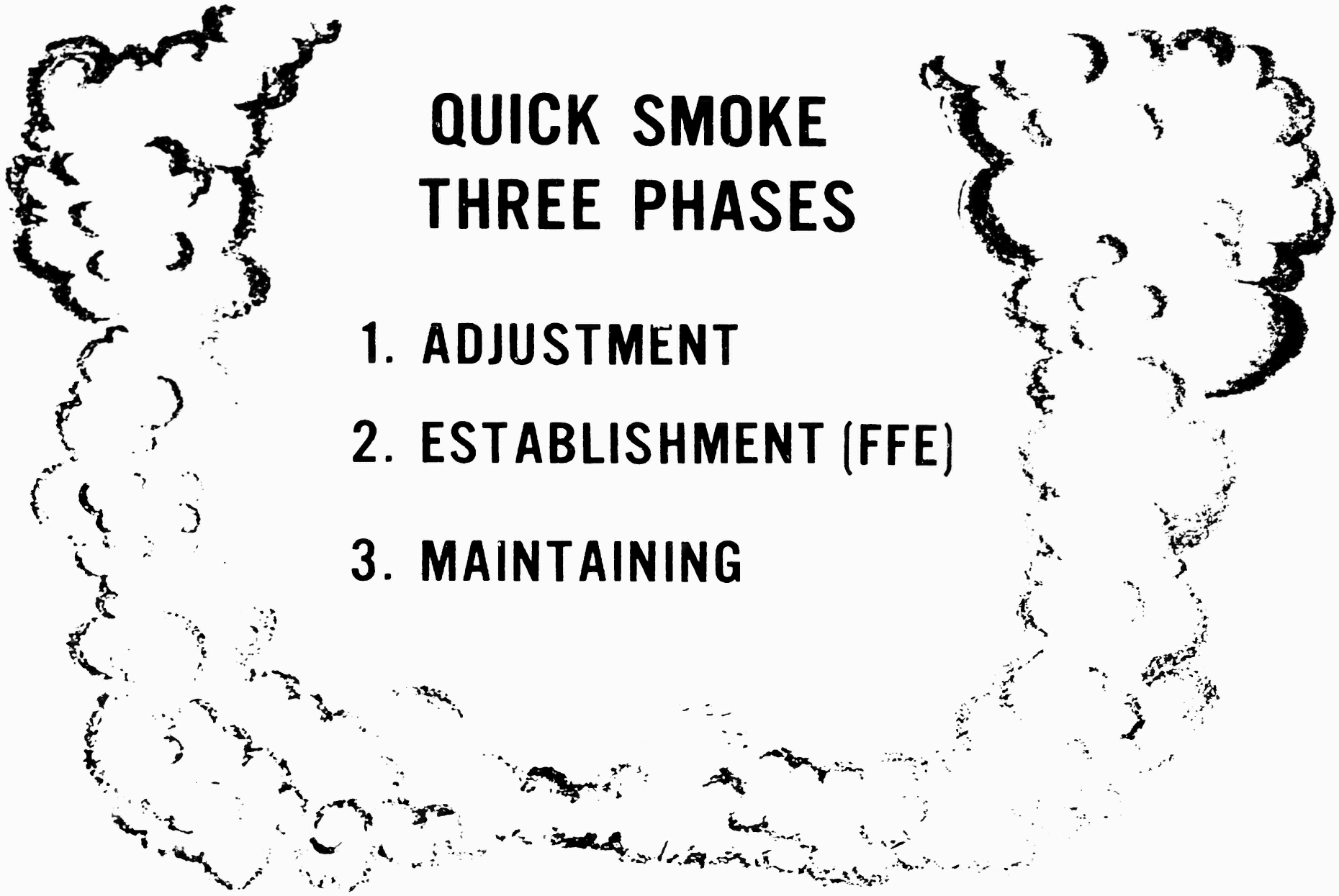
GENERAL ATMOSPHERIC CONDITIONS AND EFFECT ON SMOKE

SMOKE CONDITION (TEMPERATURE GRADIENT)	TIME OF DAY WEATHER CONDITIONS	EXPECTED SMOKE BEHAVIOR AND SMOKE WAVE BOUNDING. (WIND DIRECTION → → →)
IDEAL (INVERSION)	1. NIGHT - UNTIL 1 HOUR AFTER SUNRISE. 2. WIND SPEED LESS THAN 5 KNOTS. 3. SKY COVER LESS THAN 30 PERCENT. ALL THREE CONDITIONS MUST BE MET.	STABLE CONDITION - IDEAL FOR SMOKE EMPLOYMENT.
FAVORABLE (NEUTRAL)	IF NOT IDEAL OR MARGINAL. THIS CONDITION WILL OCCUR MOST OFTEN 1-2 HOURS BEFORE AND AFTER SUNRISE AND WHENEVER THE WIND SPEED IS 5 KNOTS OR MORE AND/OR THE SKY COVER IS 30 PERCENT OR MORE.	NEUTRAL CONDITION - FAVORABLE FOR SMOKE EMPLOYMENT.
MARGINAL (LAPSE)	1. DAY - BEGINNING AT 2 HOURS AFTER SUNRISE. 2. WIND SPEED LESS THAN 5 KNOTS. 3. SKY COVER LESS THAN 30 PERCENT. ALL THREE CONDITIONS MUST BE MET.	UNSTABLE CONDITION - MARGINAL FOR SMOKE EMPLOYMENT.

NUMBER OF WP ROUNDS PER MINUTE REQUIRED TO MAINTAIN A SMOKE CURTAIN ON A 500METER FRONT IN FLANK WINDS

RELATIVE HUMIDITY (PERCENT)	TEMPERATURE GRADIENT	WIND SPEED KNOTS						
		2	4	9	13	18	22	26
30	LAPSE	13	13	11	11	13		
	NEUTRAL	9	9	7	7	9	9	11
	INVERSION	6	6	4				
60	LAPSE	9	9	7	9	9		
	NEUTRAL	6	6	4	4	6	7	9
	INVERSION	3	3	3				
90	LAPSE	7	7	6	6	7		
	NEUTRAL	4	4	3	3	4	6	6
	INVERSION	3	3	3				

TA 606-78A


QUICK SMOKE
THREE PHASES
1. ADJUSTMENT
2. ESTABLISHMENT (FFE)
3. MAINTAINING
TA 0365-80A

APPENDIX D

FDC PROCEDURES I EXAMINATION

INSTRUCTIONS AND ANSWER KEY

1. These are in addition to instructor's orientation.
2. This examination consists of 40 questions.
3. DO NOT WRITE ON OR IN THIS TEST BOOKLET.
4. The following equipment is required for this examination:

   M16 Plotting Board

   #2 Pencil

   Computer's Record

   Data Sheet

   1 FT 81-A1-3

   Answer Sheet

   Map, Velburg

   MET Forms

FDC I EXAMINATION

SITUATION A: You are a computer for an 81mm mortar platoon and the platoon is moving to its assigned position. The platoon leader receives a call for fire and accepts the mission. He informs you that the mortars are presently at vicinity grid 041651 and instructs you to set up an observed firing chart. Using the information below construct the chart and engage the target.

NOTE: Refered deflection 2400

CALL - FOR - FIRE	FDC ORDER
D60 A/F sec GRID 046671 P. 1. O	MORT TO FFE ..... sec MORT TO ADJ ..... METH OF ADJ ... 1 Rd ..... BASIS FOR CORR ..... SHEAF CORR ..... SHELL & FUZE ... HEQ IN Adj ... PROX IN FFE ..... METHOD OF FFE ... 3 Rds ..... RG LATERAL SPREAD ..... ZONE ..... TIME OF OPENING FIRE ... W/R .....

1. What is the direction of fire?

   A. 0200
   B. 0250
   C. 0350
   D. 2400

2. What is the deflection and elevation for the first round?

	DEF	ELEV		DEF	ELEV
A.	2450	1110	C.	2400	1068
B.	0250	1091	D.	2400	1091

The FO spots the first round and sends these corrections: R100 ↓ 100. The second round is fired and the FO sends this correction: R50 + 50 FFE.

NOTE: OT DIR 0400

3. What is the correct subsequent fire command for the FFE?

	MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV
A	sec	3 Rds MOV	2320			1027
B			2450			1027
C		3 Rds Prox	2320			1027
D	sec		2450			1027

SITUATION CONTINUED: The FO sends EOM, EST 20%. You mark as tgt BC01 and update. The section leader hands you the call for fire and FDC order below and instructs you to engage the target.

CALL-FOR-FIRE	FDC ORDER
D60 A/F Shift BC 01 DIR 6400 L100-300 ENY OP	MORT TO FFE sec #1 MORT TO ADJ 1 Rd METH OF ADJ BASIS FOR CORR SHEAF CORR CONV #2 SHELL & FUZE HEQ METHOD OF FFE 2 Rds RG LATERAL SPREAD ZONE TIME OF OPENING FIRE WIR

4. What is the angle T to be recorded?

A. 0 C. 470

B. 500 D. 330

The FO spots the round and sends L50.

5. What is the deflection and elevation for this round?

	DEF	ELEV		DEF	ELEV
A.	2433	0914	C.	2344	0821
B.	2344	0981	D.	2433	0981

The FO sends this correction +50 FFE.

6. What is the command deflection(s) for the FFE?

A. 2351

C. 1- 2372
2- 2351
3- 2330

B. 1- 2459
2- 2449
3- 2439

D. 1- 2331
2- 2351
3- 2371

FO sends EOM, OP Dest. Mark as tgt BC02.

SITUATION B: After completing the mission the platoon moves to vicinity grid 047662. You will be here for a short period of time and the platoon leader tells you to set up an observed chart and fire a mark center sector for the FO. Using the information below construct the chart and fire the MCS.

1. Direction of fire 0820
2. Relered deflection 0700
3. Distance to MCS 3600 meters

SITUATION CONTINUED: After firing the MCS the section leader hands you the call for fire and FDC order below and instructs you to compute the mission.

CALL-FOR-FIRE	FDC ORDER
D62 A/F GRID 078692 C.1.O	MORT TO FFE sec. MORT TO ADJ #2 METH OF ADJ 1 Rd BASIS FOR CORR SHEAF CORR SHELL & FUZE HEQ METHOD OF FFE 5 Rds RG LATERAL SPREAD ZONE TIME OF OPENING FIRE WIK

7. What is the correct initial fire command?

A INITIAL FIRE COMMAND

MORT TO FOLLOW sec.
SHELL & FUZE HEQ
MORT TO FIRE #2
METHOD OF FIRE 1 Rd
5 Rds IN FFE
DEFLECTION 0720
CHARGE 9
TIME SETTING
ELEVATION 0964

B INITIAL FIRE COMMAND

MORT TO FOLLOW sec.
SHELL & FUZE HEQ
MORT TO FIRE
METHOD OF FIRE 1 Rd
5 Rds IN FFE
DEFLECTION 0720
CHARGE 9
TIME SETTING
ELEVATION 0964

C INITIAL FIRE COMMAND

MORT TO FOLLOW sec.
SHELL & FUZE HEQ
MORT TO FIRE
METHOD OF FIRE 1 Rd
DEFLECTION 0640
CHARGE 9
TIME SETTING
ELEVATION 0964

D INITIAL FIRE COMMAND

MORT TO FOLLOW sec.
SHELL & FUZE HEQ
MORT TO FIRE #2
METHOD OF FIRE 1 Rd
5 Rds IN FFE
DEFLECTION 0720
CHARGE 9
TIME SETTING
ELEVATION 0917

The FO sends FFE. The rounds are fired and the FO sends EOM, EST 30% CAS. Mark as tgt BD03.

SITUATION CONTINUED: After updating the platoon leader receives a call for fire and after checking his map issues the FDC order. He instructs you to compute the mission. Using the call for fire and FDC order below compute the mission.

CALL - FOR - FIRE	FDC ORDER
D62 A/F Shift BD 03 DIR 0500 L700 -300 Ammo Point	MORT TO FFE sec MORT TO ADJ METH OF ADJ 1 Rd BASIS FOR CORR SHEAF CORR SHELL & FUZE HEQ IN Adj WP IN FFE METHOD OF FFE 4 Rds RG LATERAL SPREAD ZONE TIME OF OPENING FIRE WIR

8. What is the deflection(s) and elevation for the first round(s)?

	DEF	ELEV		DEF	ELEV
A.	0844	0995	C.	0844	0941
B.	0646	0995	D.	0646	0941

The FO spots the first round(s) and sends these corrections L300 - 200.

9. What is the command range and charge for these rounds?

	Range	Charge		Range	Charge
A.	3500	7	C.	4000	8
B.	3600	7	D.	3600	8

The round(s) are fired and the FO sends this correction -50 FFE.

10. What is the subsequent command for the FFE?

	SUBSEQUENT COMMANDS					
	MORT FIRE	METHOD FIRE	DEFL	RG CHG	TIME SETTING	ELEV
A			0916	7		0839
B	sec	4 Rds	0916			0968
C	sec	4 Rds	0916	8		0978
D		4 Rds	0916			0968

The rounds are fired and the FO sends EOM, Ammo Point Burning.

SITUATION CONTINUED: After marking the tgt BD04 and updating, you are handed the call for fire and FDC order below. You instruct the RTO to request the FO's azimuth to two unknown points. The FO sends MCS - 0710, BD04 0500. After locating the FO you compute the mission.

CALL-FOR-FIRE	FDC ORDER
D62 A/F POLAR DIR 0880 DIST 3000 TROOP AND VEH'S IN WOOD LINE	MSN TO FFE SEC MSN TO ADJ #2 METH OF ADJ 1Rd BASIS FOR CORR SHEAF CORR SHELL & FUZE HEQ IN ADJ HEQ & WP IN FFE METHOD OF FFE 3 HE/2 WP RG LATERAL SPREAD ZONE TIME OF OPENING FIRE WIR

11. What is the correct heading data?

A	VI	0	GUN RG CORR	0	CHART DEFL	0456	CHART RG 2725
	DEFL CORR	0			ANGLE T	160	CHG 5
B	VI	0	GUN RG CORR	0	CHART DEFL	0620	CHART RG 3000
	DEFL CORR	0			ANGLE T	0	CHG 5
C	VI	0	GUN RG CORR	0	CHART DEFL	0456	CHART RG 3000
	DEFL CORR	0			ANGLE T	160	CHG 6
D	VI	0	GUN RG CORR	0	CHART DEFL	0620	CHART RG 2725
	DEFL CORR	0			ANGLE T	0	CHG 5

The FO spots the round and sends these corrections R100 - 100 FFE.

12. What is the total number of rounds in the Rds Exp column after firing the FFE?

A. 1 HE
6 WP

B. 6 HE
6 WP

C. 7 HE
6 WP

D. 7 HE
7 WP

The FO sends EOM, EST 10% CAS.

SITUATION C: After 4 weeks in the field your platoon is sent to a rear area. While there the platoon leader decides to go to the range. He stops at range control and obtains the following safety information:

1.	Firing position coordinates	0300 6500
2.	Charge Zone	1 - 6
3.	Min Range 500	Max Range 2850
4.	Left limit AZ 1850	Right limit AZ 2500
5.	Refered Deflection	2800

SITUATION CONTINUED: With above information construct an observed firing chart and apply the safety fan.

13. What is the deflection for the left/right limit AZ?

	Left DEF	Right DEF
A.	3125	2740
B.	2475	3000
C.	3150	2500
D.	2450	3100

14. What is the max charge and min elevation that can be used?

	CHG	ELEV
A.	6	1076
B.	7	1162
C.	5	0899
D.	4	0800

15. What is the max elevation for charge 4?

A. 1507
B. 1497
C. 1410
D. 0800

SITUATION D: After a week in the rear area the mortar platoon is sent out to the field to vicinity grid 105 673 to conduct a registration mission. While the platoon is firing the registration, the platoon leader determines an 8 digit grid location and altitude of the mortar position. He instructs you to construct a modified observed firing chart. Use the information below.

1.	Mortar Grid	1050 6730	Alt 420
2.	OP 1 Grid	100 670	Alt 470
3.	Direction of Fire	3200	
4.	Refered Deflection	4800	
5.	Grid Intersection	11/65	
6.	Forward plot RPl	Deflection 4810 Chart Range 3500 ALT 500	

SITUATION CONTINUED: The platoon leader hands you a call for fire and FDC order below and instructs you to compute the mission:

CALL - FOR - FIRE	FDC ORDER
D 01 A/F Shift RPI DIR 3450 R 200 - 200 DN 10 ANTI TANK SITE W/ COVER CONV #2	MORT TO FFE ... SEC MORT TO ADJ ... #1 METH OF ADJ ... 1 RD BASIS FOR CORR ... SHEAF CORR ... CONV #2 SHELL & FUZE ... HEQ IN ADJ HEQ IN FFE METHOD OF FFE ... 3 RDS RG LATERAL SPREAD ... ZONE ... TIME OF OPENING FIRE ... WIR

16. What is the range correction for VI?

A. +40 C. +35

B. +70 D. +80

17. What is the correct initial fire command?

A INITIAL FIRE COMMAND

MORT TO FOLLOW ... SEC
SHELL & FUZE ... HEQ
MORT TO FIRE ... #1
METHOD OF FIRE ... 1 RD
... 4154
DEFLECTION ...
CHARGE ... 6
...
TIME SETTING ...
ELEVATION ... 0886

B INITIAL FIRE COMMAND

MORT TO FOLLOW ... SEC
SHELL & FUZE ... HEQ
MORT TO FIRE ...
METHOD OF FIRE ... 1 RD
3 RDS HEQ IN FFE
DEFLECTION ... 3347
CHARGE ... 6
...
TIME SETTING ...
ELEVATION ... 0911

C INITIAL FIRE COMMAND

MORT TO FOLLOW ... SEC
SHELL & FUZE ... HEQ
MORT TO FIRE ...
METHOD OF FIRE ... 1 RD
3 RDS HEQ IN FFE
DEFLECTION ... 3347
CHARGE ... 6
...
TIME SETTING ...
ELEVATION ... 0886

D INITIAL FIRE COMMAND

MORT TO FOLLOW ... SEC
SHELL & FUZE ... HEQ
MORT TO FIRE ... #1
METHOD OF FIRE ... 1 RD
3 RDS HEQ IN FFE
DEFLECTION ... 4154
CHARGE ... 6
...
TIME SETTING ...
ELEVATION ... 0886

The FO spots the first round(s) and sends this correction: +50 FFE.

18. What are the deflections required to fire these rounds?

A. 1- 4767
2- 4755
3- 4743

B. 1- 4745
2- 4755
3- 4765

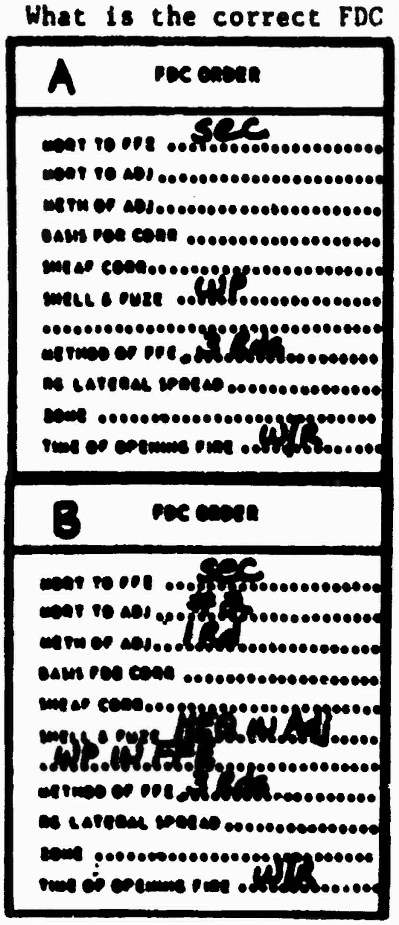
C. 1- 3377
2- 3365
3- 3353

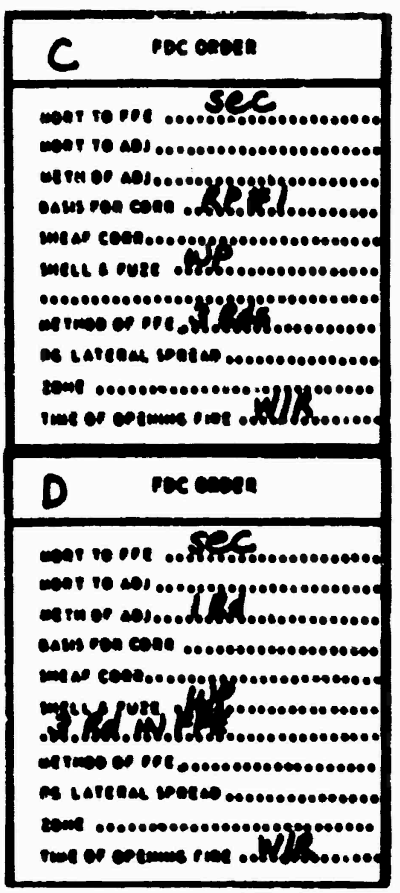
D. 1- 3666
2- 3656
3- 3646

The FO sends EOM, Tgt Dest.
NOTE: Mark as Tgt CD 004.

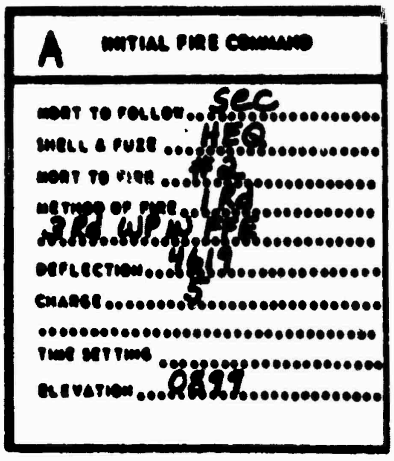
SITUATION CONTINUED: After updating the section leader hands you the call for fire below and instructs you to compute the mission.

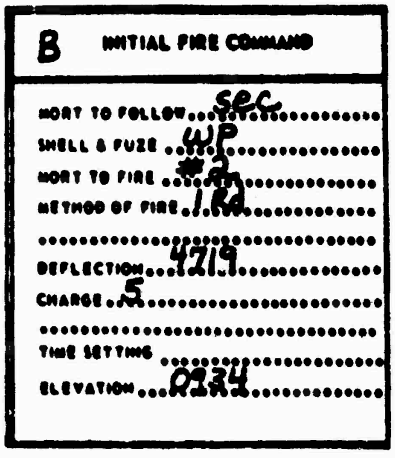
19. What is the correct FDC order?

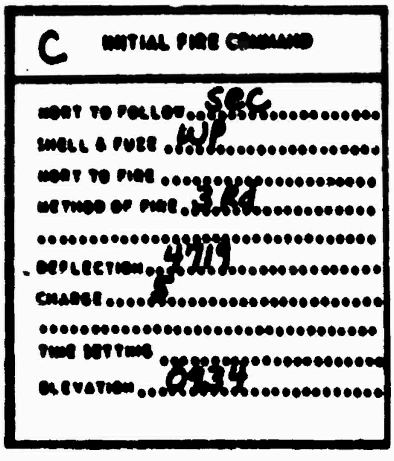


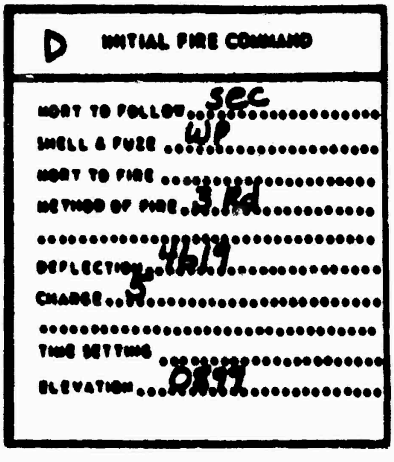


20. What is the initial fire command?









21. What is the VI for this mission?

A. +40

B. 0

C. +20

D. -40

The round(s) are fired and the FO sends EOM, 6 trucks burning.

NOTE: Mark as Tgt CD 05

SITUATION CONTINUED: After updating, you are handed the call for fire and FDC order below and instructed to compute the mission:

CALL-FOR-FIRE	FDC ORDER
D 06 A/F POLAR DIR 3010 DIST 3400 MORTAR POSITION	MORT TO FFE SEC MORT TO ADJ #2 METH OF ADJ 1 RD BASIS FOR CORR SHEAF CORR SHELL & FUZE HEQ METHOD OF FFE 5 Adj RG LATERAL SPREAD ZONE TIME OF OPENING FIRE W/R

22. What is the altitude of the target?

A. 420

B. 520

C. 470

D. 495

23. What is the command deflection and elevation to fire the first round?

	DEF	ELEV		DEF	ELEV
A.	4835	0911	C.	4835	0862
B.	4865	0862	D.	4865	0911

The FO spots the round and sends these corrections, L100 + 100.

24. What is the chart deflection for round 2?

A. 4868

B. 4902

C. 4848

D. 4805

The FO sends L50 FFE.

25. What is the correct subsequent fire command for the FFE?

	MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV
A	sec	5Rd	4968			0862
B	sec		4881			0896
C	sec	5Rd	4881			0862
D	sec		4968			0896

NOTE: EOM, mark as Tgt CD 06

SITUATION E: Your platoon moves into a surveyed firing position and the platoon leader instructs you to construct a surveyed firing chart. Using the information listed below construct the chart.

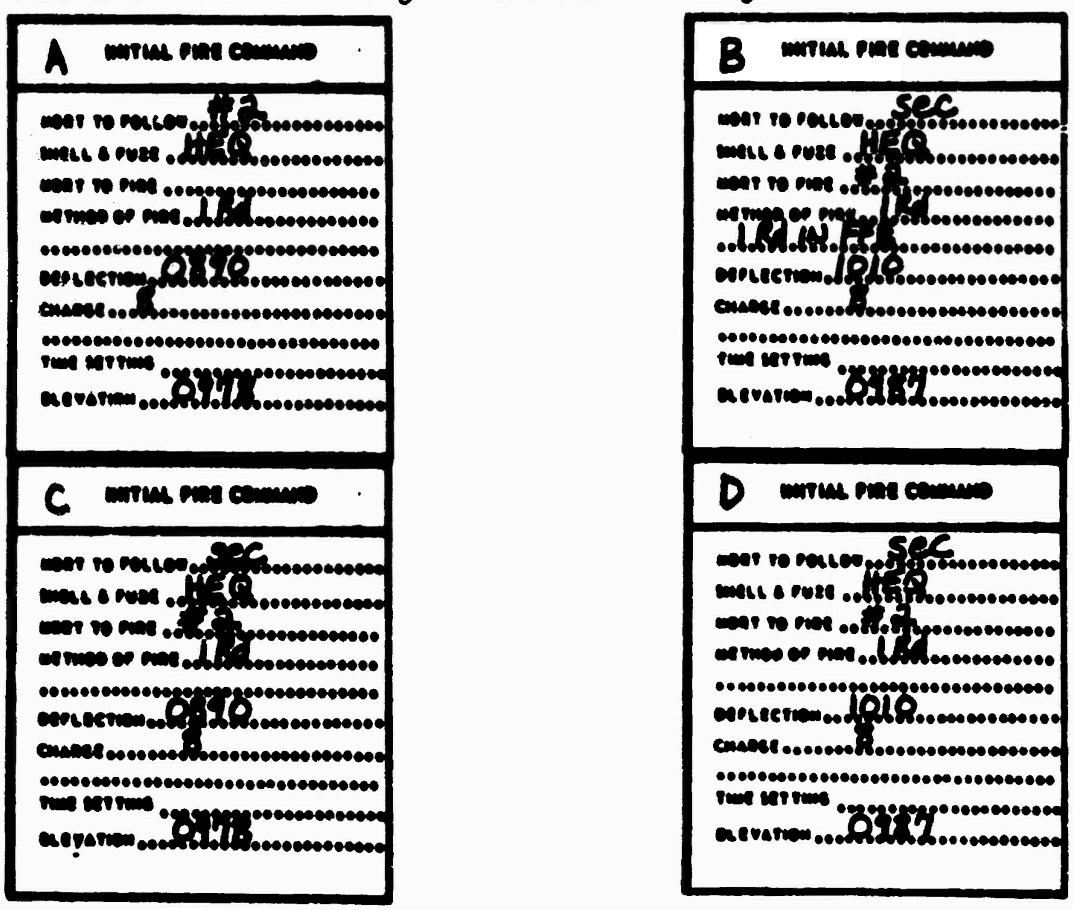
1.	Mortar grid	1190 6843	Alt 400
2.	Reference point grid	1576 6790	Alt 430
3.	Refered deflection	1000	
4.	Grid intersection	14/69	

26. What is the direction of fire?

A. 1000
B. 1700
C. 1740
D. 1860

SITUATION CONTINUED: You are going to conduct a coordinated registration and you send a MTO: Register RP #1. The FO sends DIRECTION 1500.

27. What is the initial firing command sent to the gun section?



The round is fired and the FO sends L100 + 150. The second round is fired. The FO spots that and sends -50. The third round is fired and the FO sends R25 - 25, EOM R/C. You tell the FO to prepare to adjust sheaf. He sends S/L.

28. What is the correct subsequent fire command for the section?

	SHORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV
A	Sec	INC S/R	1036			0899
B	Sec	INC S/L	1036			0970
C	Sec	[illegible]	1036	/7		0896
D			1036			0970

SITUATION CONTINUED: After the section fires, the FO spots the round and sends the following corrections:

#1. R20

#3. R10

29. What are the correct subsequent commands for 1 and 3?

	SHORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV
A	113	DNF	1)1031			
			3)1033			
B	113	DNF	1)1041			
			3)1039			
C	Sec	REFER	1036	REALINE A/P		
D	113	I Rd	1)1031			
			3)1033			0970

SITUATION CONTINUED: After the section refires, you in the FDC are working the corrections for the registration.

30. What is the range correction?

A. +50

B. -50

C. +100

D. -100

31. What is the range correction factor?

A. -13

B. +13

C. +50

D. +12.8

SITUATION CONTINUED: The initial chart deflection was 1010, the final command deflection was 1036.

32. What is the deflection correction?

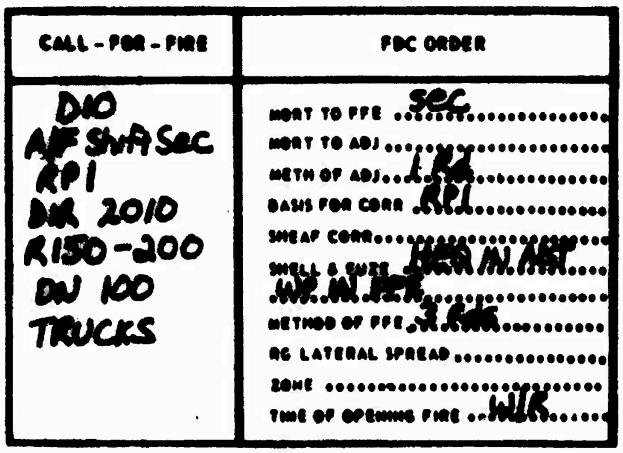
A. R26

B. 0

C. L26

D. L20

SITUATION CONTINUED: After updating the board and data sheet, the section leader hands you this call for fire and FDC order. He instructs you to compute the mission.



33. What is the range correction for VI?

A. -70

B. +20

C. +48

D. -35

34. What is the total range correction (TRC) to apply?

A. +83

B. -35

C. +35

D. +13

35. What is the command deflection for the first round?

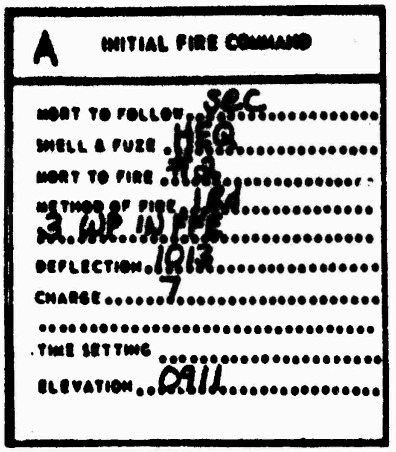
A. 1013

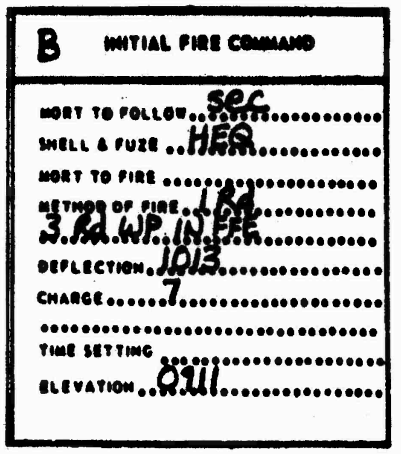
B. 0961

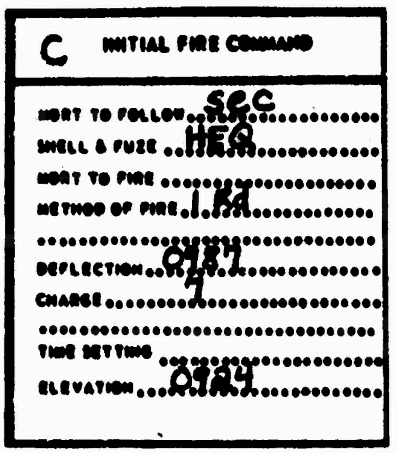
C. 0987

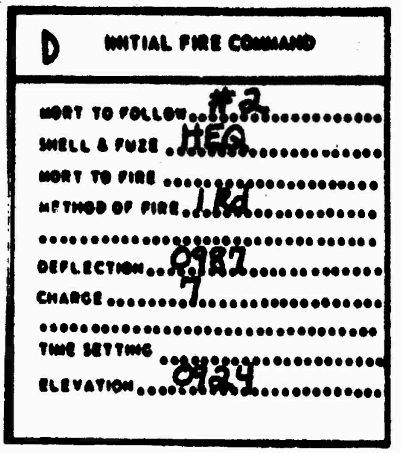
D. 1050

36. What is the correct initial fire command?









The FO spots the round(s) and sends FFE. You fire the rounds, the FO sends EOM, 6 trucks burning. Mark as Tgt DC 10.

SITUATION CONTINUED: During the registration you received this MET message:

MET B 31	MIF MIF
011250	061 987
003110	998 976
013009	029 976
023018	039 974
032805	976 999
043010	020 976
052711	010 987
062904	987 987

You request the platoon sergeant to give you the powder temperature. He tells you 78°. After receiving the information compute the MET message.

37. What is the corrected values for air temperature and air density?

A. 119.5 95.5

B. - .5 -2.1

C. +2.1 + .5

D. 102.5 99.7

38. What is the unit correction for air density?

A. -11.8

B. 11.7

C. -12.1

D. 11.9

SITUATION CONTINUED: After computing the MET and determining the corrections to be R12 - 6, several hours later you receive another MET. After computing it and determining the correction L31 + 30, you compare and apply the corrections to update your firing data.

39. What is the RCF to apply?

A. +22

B. -18

C. +48

D. +30

40. What is the deflection correction to apply?

A. R12

B. L69

C. L26

D. L31

EXAMINATION

FDC PROCEDURES I

ANSWER KEY

EXAMINATION

FDC PROCEDURES I

QUESTION POINT VALUE

QUESTION	VALUE	QUESTION	VALUE
1	2	21	2
2	2	22	3
3	3	23	3
4	2	24	2
5	2	25	3
6	2	26	2
7	2	27	3
8	3	28	3
9	3	29	2
10	3	30	3
11	3	31	3
12	2	32	2
13	3	33	3
14	2	34	3
15	2	35	2
16	3	36	2
17	3	37	2
18	3	38	2
19	2	39	2
20	3	40	3

FDC I EXAMINATION

SITUATION A: You are a computer for an 81mm mortar platoon and the platoon is moving to its assigned position. The platoon leader receives a call for fire and accepts the mission. He informs you that the mortars are presently at vicinity grid 041651 and instructs you to set up an observed firing chart. Using the information below construct the chart and engage the target.

NOTE: Refered deflection 2400

CALL-FOR-FIRE	FDC ORDER
D60 A/F sec GRID 046671 P. 1.0	MORT TO FFE ... sec MORT TO ADJ ... METH OF ADJ ... 1 RD BASIS FOR CORR ... SHEAF CORR ... SHELL & FUZE ... HE/Q IN ADJ ... PROX IN FFE METHOD OF FFE ... 3 RDS RG LATERAL SPREAD ... ZONE ... TIME OF OPENING FIRE ... W/R

1. What is the direction of fire?

A. 0200
(B.) 0250
C. 0350
D. 2400

2. What is the deflection and elevation for the first round?

	DEF	ELEV		DEF	ELEV
A.	2450	1110	C.	2400	1068
B.	0250	1091	(D.)	2400	1091

The FO spots the first round and sends these corrections: R100 ↓ 100. The second round is fired and the FO sends this correction: R50 ↓ 50 FFE.

NOTE: OT DIR 0400

3. What is the correct subsequent fire command for the FFE?

	MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV
A	sec	[illegible]	2320			1027
B			2450			1027
(C)		[illegible]	2320			1027
D	sec		2460			1027

SITUATION CONTINUED: The FO sends EOM, EST 20%. You mark as tgt BC01 and update. The section leader hands you the call for fire and FDC order below and instructs you to engage the target.

CALL-FOR-FIRE	FDC ORDER
D60 A/F Shift BC 01 DIR 6400 L100-300 ENY OP	MSN TO FFE ... sec MSN TO ADJ ... #1 METH OF ADJ ... 1 Rd BASIS FOR CORR ... SHEAF CORR ... CONV #2 SHELL & FUZE ... HEG ... METHOD OF FFE ... 2 Rds RG LATERAL SPREAD ... ZONE ... TIME OF OPENING FIRE ... WIR

4. What is the angle T to be recorded?

A. 0 C. 470

B. 500 (D.) 330

The FO spots the round and sends L50.

5. What is the deflection and elevation for this round?

	DEF	ELEV		DEF	ELEV
A.	2433	0914	C.	2344	0821
(B.)	2344	0981	D.	2431	0981

The FO sends this correction +50 FFE.

6. What is the command deflection(s) for the FFE?

A. 2351

(C.) 1- 2372
2- 2351
3- 2330

B. 1- 2459
2- 2449
3- 2439

D. 1- 2331
2- 2351
3- 2371

FO sends EOM, OP Dest. Mark as tgt BC02.

SITUATION B: After completing the mission the platoon moves to vicinity grid 047662. You will be here for a short period of time and the platoon leader tells you to set up an observed chart and fire a mark center sector for the FO. Using the information below construct the chart and fire the MCS.

1. Direction of fire 0820
2. Refered deflection 0700
3. Distance to MCS 3600 meters

SITUATION CONTINUED: After firing the MCS the section leader hands you the call for fire and FDC order below and instructs you to compute the mission.

CALL-FOR-FIRE	FDC ORDER
D62 A/F GRID 078692 C.1.O	MORT TO FFE sec MORT TO ADJ #2 METH OF ADJ 1Rd BASIS FOR CORR SHEAF CORR SHELL & FUZE HEQ METHOD OF FFE 5 Rds RG LATERAL SPREAD ZONE TIME OF OPENING FIRE WIA

7. What is the correct initial fire command?

A INITIAL FIRE COMMAND

MORT TO FOLLOW sec
SHELL & FUZE HEQ
MORT TO FIRE #2
METHOD OF FIRE 1Rd
5 Rds IN EFF
DEFLECTION 0820
CHARGE 9
TIME SETTING
ELEVATION 0964

B INITIAL FIRE COMMAND

MORT TO FOLLOW sec
SHELL & FUZE HEQ
MORT TO FIRE
METHOD OF FIRE 1Rd
5 Rds IN EFF
DEFLECTION 0820
CHARGE 9
TIME SETTING
ELEVATION 0964

C INITIAL FIRE COMMAND

MORT TO FOLLOW sec
SHELL & FUZE HEQ
MORT TO FIRE
METHOD OF FIRE 1Rd
DEFLECTION 0820
CHARGE 9
TIME SETTING
ELEVATION 0964

D INITIAL FIRE COMMAND

MORT TO FOLLOW sec
SHELL & FUZE HEQ
MORT TO FIRE #2
METHOD OF FIRE 1Rd
5 Rds IN EFF
DEFLECTION 0820
CHARGE 9
TIME SETTING
ELEVATION 0917

The FO sends FFE. The rounds are fired and the FO sends EOM, EST 30% CAS. Mark as tgt BD03.

SITUATION CONTINUED: After updating the platoon leader receives a call for fire and after checking his map issues the FDC order. He instructs you to compute the mission. Using the call for fire and FDC order below compute the mission.

CALL-FOR-FIRE	FDC ORDER
D62 A/F Shift BD 03 DIR 0500 L700 -300 Ammo Point	MORT TO FFE sec MORT TO ADJ METH OF ADJ 1 Rd BASIS FOR CORR SHEAF CORR SHELL & FUZE HE/Q IN ADJ WP IN FFE METHOD OF FFE 4 Rds RG LATERAL SPREAD ZONE TIME OF OPENING FIRE WIR

8. What is the deflection(s) and elevation for the first round(s)?

	DEF	ELEV		DEF	ELEV
(A.)	0844	0995	C.	0844	0941
B.	0646	0995	D.	0646	0941

The FO spots the first round(s) and sends these corrections L300 - 200.

9. What is the command range and charge for these rounds?

	Range	Charge		Range	Charge
A.	3500	7	C.	4000	8
(B.)	3600	7	D.	3600	8

The round(s) are fired and the FO sends this correction -50 FFE.

10. What is the subsequent command for the FFE?

	SUBSEQUENT COMMANDS					
	MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV
A			0916	7		0839
B	sec	4 Rds	0916			0968
C	sec	4 Rds	0916	8		0978
(D)		4 Rds	0916			0968

The rounds are fired and the FO sends EOM, Ammo Point Burning.

SITUATION CONTINUED: After marking the tgt BD04 and updating, you are handed the call for fire and FDC order below. You instruct the RTO to request the FO's azimuth to two unknown points. The FO sends MCS - 0710, BD04 0500. After locating the FO you compute the mission.

CALL-FOR-FIRE	FDC ORDER
D62 A/F POLAR DIR 0880 DIST 3000 TROOP AND VEH'S IN WOOD LINE	MSN TO FFE spec MSN TO ADJ #3 METH OF ADJ 180 BASIS FOR CORR SHEAF CORR SHELL & FUZE HE/Q IN ADJ RDS & TYP IN FFE 3 HE/3 WP METHOD OF FFE AS LATERAL SPREAD ZONE TIME OF OPENING FIRE WIR

11. What is the correct heading data?

(A)

VI 0	GUN AS CORR 0	CHART DEFL 0456	CHART RG 2725
DEFL CORR 0		ANGLE T 160	CHG 5

B

VI 0	GUN AS CORR 0	CHART DEFL 0620	CHART RG 3000
DEFL CORR 0		ANGLE T 0	CHG 5

C

VI 0	GUN AS CORR 0	CHART DEFL 0456	CHART RG 3000
DEFL CORR 0		ANGLE T 160	CHG 6

D

VI 0	GUN AS CORR 0	CHART DEFL 0620	CHART RG 2725
DEFL CORR 0		ANGLE T 0	CHG 5

The FO spots the round and sends these corrections R100 - 100 FFE.

12. What is the total number of rounds in the Rds Exp column after firing the FFE?

A. 1 HE
6 WP

(C.) 7 HE
6 WP

B. 6 HE
6 WP

D. 7 HE
7 WP

The FO sends EOM, EST 10% CAS.

SITUATION C: After 4 weeks in the field your platoon is sent to a rear area. While there the platoon leader decides to go to the range. He stops at range control and obtains the following safety information:

1.	Firing position coordinates	0300 6500
2.	Charge Zone	1 - 6
3.	Min Range 500	Max Range 2850
4.	Left limit AZ 1850	Right limit AZ 2500
5.	Refered Deflection	2800

SITUATION CONTINUED: With above information construct an observed firing chart and apply the safety fan.

13. What is the deflection for the left/right limit AZ?

	Left DEF	Right DEF
A.	3125	2740
B.	2475	3000
(C.)	3150	2500
D.	2450	3100

14. What is the max charge and min elevation that can be used?

	CHG	ELEV
(A.)	6	1076
B.	7	1162
C.	5	0899
D.	4	0800

15. What is the max elevation for charge 4?

A. 1507
C. 1410
(B.) 1497
D. 0800

SITUATION D: After a week in the rear area the mortar platoon is sent out to the field to vicinity grid 105 673 to conduct a registration mission. While the platoon is firing the registration, the platoon leader determines an 8 digit grid location and altitude of the mortar position. He instructs you to construct a modified observed firing chart. Use the information below.

1.	Mortar Grid	1050 6730	Alt 420
2.	OP 1 Grid	100 670	Alt 470
3.	Direction of Fire	3200	
4.	Refered Deflection	4800	
5.	Grid Intersection	11/65	
6.	Forward plot RPI	Deflection 4810 Chart Range 3500 Alt 500	

SITUATION CONTINUED: The platoon leader hands you a call for fire and FDC order below and instructs you to compute the mission:

CALL-FOR-FIRE	FDC ORDER
D 01 A/F Shift RPI DIR 3450 R 200 - 200 DN 10 ANTI TANK SITE W/ COVER CONV #2	ADJT TO FFE ... SEC ADJT TO ADJ ... #1 METH OF ADJ ... IRA BASIS FOR CORR ... SHEAF CORR ... CONV #2 SHELL & FUZE ... HEQ IN ADJT HEQ IN FFE METHOD OF FFE ... 3 RDS RG LATERAL SPREAD ... ZONE ... WR TIME OF OPENING FIRE ...

16. What is the range correction for V1?

A. +40 (C.) +35

B. +70 D. +80

17. What is the correct initial fire command?

A INITIAL FIRE COMMAND

ADJT TO FOLLOW ... SEC
SHELL & FUZE ... HEQ
ADJT TO FIRE ... #1
METHOD OF FIRE ... IRA
DEFLECTION ... 4444
CHARGE ... 1
TIME SETTING ...
ELEVATION ... 0886

B INITIAL FIRE COMMAND

ADJT TO FOLLOW ... SEC
SHELL & FUZE ... HEQ
ADJT TO FIRE ...
METHOD OF FIRE ... IRA
3 RDS HEQ IN FFE
DEFLECTION ... 4444
CHARGE ... 1
TIME SETTING ...
ELEVATION ... 0891

C INITIAL FIRE COMMAND

ADJT TO FOLLOW ... SEC
SHELL & FUZE ... HEQ
ADJT TO FIRE ...
METHOD OF FIRE ... IRA
3 RDS HEQ IN FFE
DEFLECTION ... 4444
CHARGE ... 1
TIME SETTING ...
ELEVATION ... 0886

(D) INITIAL FIRE COMMAND

ADJT TO FOLLOW ... SEC
SHELL & FUZE ... HEQ
ADJT TO FIRE ... #1
METHOD OF FIRE ... IRA
3 RDS HEQ IN FFE
DEFLECTION ... 4444
CHARGE ... 1
TIME SETTING ...
ELEVATION ... 0886

The FO spots the first round(s) and sends this correction: +50 FFE.

18. What are the deflections required to fire these rounds?

(A.) 1- 4767
2- 4755
3- 4743

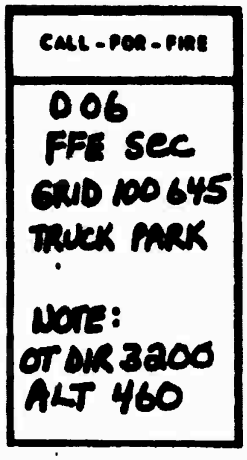
B. 1- 4745
2- 4755
3- 4765

C. 1- 3377
2- 3365
3- 3353

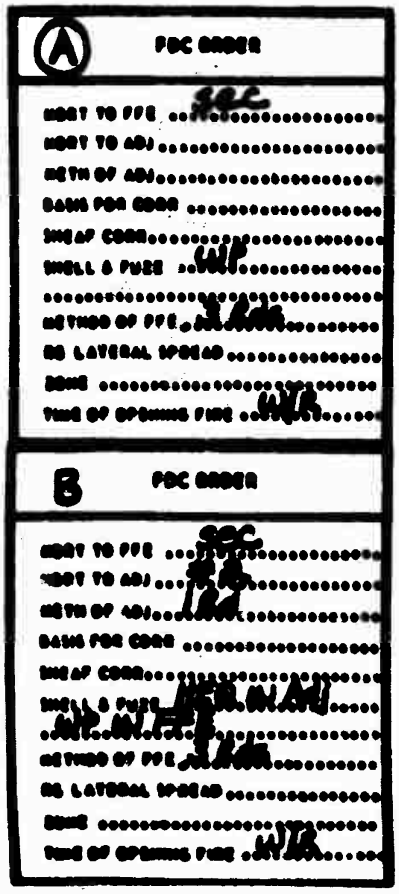
D. 1- 3666
2- 3656
3- 3646

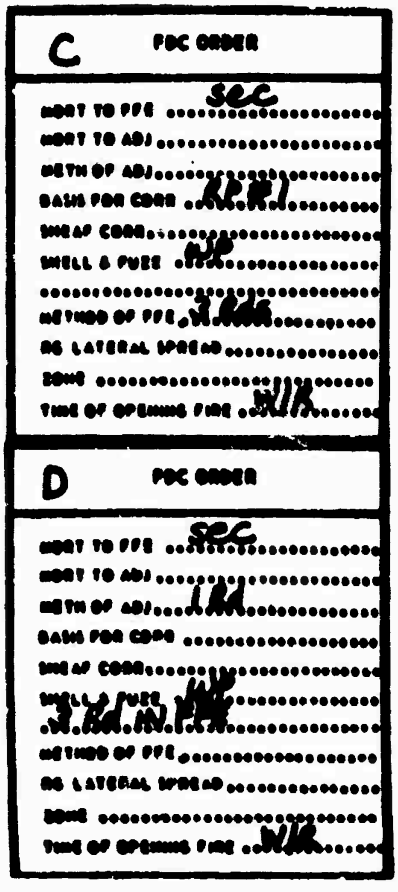
The FO sends EOM, Tgt Dest.
NOTE: Mark as Tgt CD 004.

SITUATION CONTINUED: After updating the section leader hands you the call for fire below and instructs you to compute the mission.

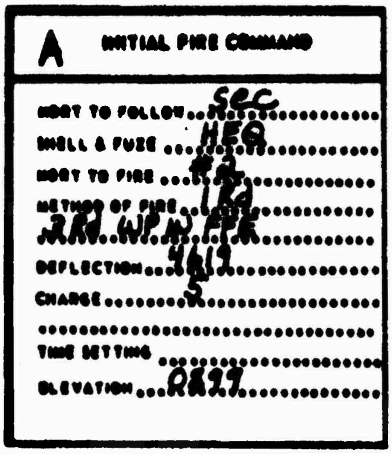


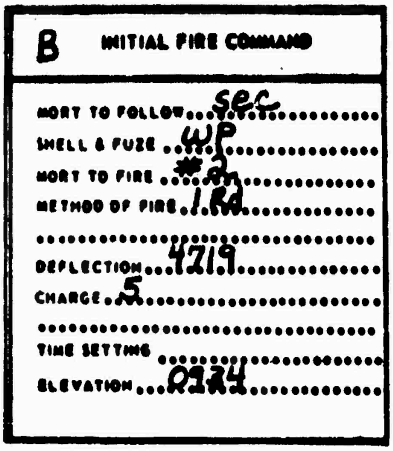
19. What is the correct FDC order?

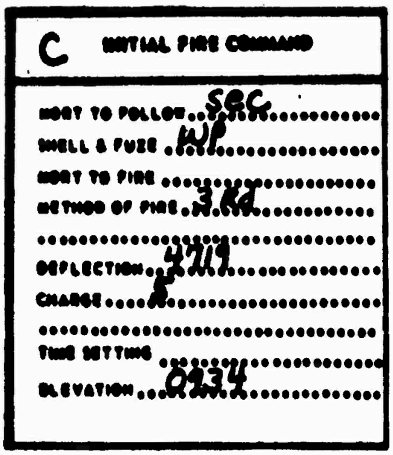


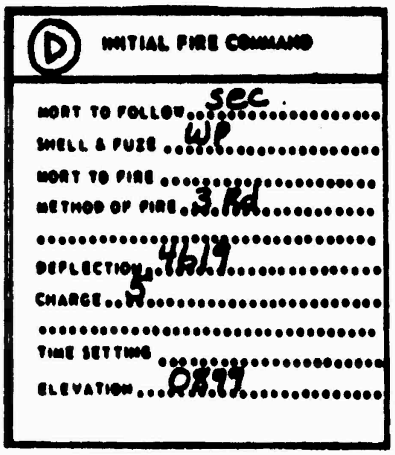


20. What is the initial fire command?









21. What is the VI for this mission?

(A.) +40
B. 0
C. +20
D. -40

The round(s) are fired and the FO sends EOM, 6 trucks burning.

NOTE: Mark as Tgt CD 05

SITUATION CONTINUED: After updating, you are handed the call for fire and FDC order below and instructed to compute the mission:

CALL-FOR-FIRE	FDC ORDER
D 06 A/F POLAR DIR 3010 DIST 3400 MORTAR POSITION	MORT TO FFE sec MORT TO ADJ #2 METH OF ADJ 1 Rd BASIS FOR CORR SHEAF CORR SHELL & FUZE HEQ METHOD OF FFE 5 Rds RG LATERAL SPREAD ZONE TIME OF OPENING FIRE W/R

22. What is the altitude of the target?

A. 420
B. 520
(C.) 470
D. 495

23. What is the command deflection and elevation to fire the first round?

	DEF	ELEV		DEF	ELEV
(A.)	4835	0911	C.	4835	0862
B.	4865	0862	D.	4865	0911

The FO spots the round and sends these corrections, L100 + 100.

24. What is the chart deflection for round 2?

(A.) 4868
B. 4902
C. 4848
D. 4805

The FO sends L50 FFE.

25. What is the correct subsequent fire command for the FFE?

	MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV
A	SEC	5 RD	4968			0862
B	SEC		4881			0896
(C)	SEC	5 RD	4881			0862
D	SEC		4968			0896

NOTE: EOM, mark as Tgt CD 06

SITUATION E: Your platoon moves into a surveyed firing position and the platoon leader instructs you to construct a surveyed firing chart. Using the information listed below construct the chart.

1.	Mortar grid	1190 6843	Alt 400
2.	Reference point grid	1576 6790	Alt 430
3.	Refered deflection	1000	
4.	Grid intersection	14/69	

26. What is the direction of fire?

A. 1000 (C.) 1740

B. 1700 D. 1860

SITUATION CONTINUED: You are going to conduct a coordinated registration and you send a MTO: Register RP #1. The FO sends DIRECTION 1500.

27. What is the initial firing command sent to the gun section?

A INITIAL FIRE COMMAND

MORT TO FOLLOW ... #2
SHELL & FUZE ... HEQ
MORT TO FIRE ...
METHOD OF FIRE ... 1 RD
DEFLECTION ... 0890
CHARGE ... 8
TIME SETTING ...
ELEVATION ... 0978

B INITIAL FIRE COMMAND

MORT TO FOLLOW ... SEC
SHELL & FUZE ... HEQ
MORT TO FIRE ... #2
METHOD OF FIRE ... 1 RD IN FFE
DEFLECTION ... 1010
CHARGE ... 8
TIME SETTING ...
ELEVATION ... 0987

C INITIAL FIRE COMMAND

MORT TO FOLLOW ... SEC
SHELL & FUZE ... HEQ
MORT TO FIRE ... #2
METHOD OF FIRE ... 1 RD
DEFLECTION ... 0890
CHARGE ... 8
TIME SETTING ...
ELEVATION ... 0978

(D) INITIAL FIRE COMMAND

MORT TO FOLLOW ... SEC
SHELL & FUZE ... HEQ
MORT TO FIRE ... #2
METHOD OF FIRE ... 1 RD
DEFLECTION ... 1010
CHARGE ... 8
TIME SETTING ...
ELEVATION ... 0987

The round is fired and the FO sends L100 ↓ 150. The second round is fired. The FO spots that and sends -50. The third round is fired and the FO sends R25 - 25, EOM R/C. You tell the FO to prepare to adjust sheaf. He sends S/L.

28. What is the correct subsequent fire command for the section?

	MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV
A	Sec	IR S/R	1036			0899
(B)	sec	IR S/L	1036			0970
C	sec	IR R/L	1036	7		0896
D			1036			0970

SITUATION CONTINUED: After the section fires, the FO spots the round and sends the following corrections:

#1. R20

#3. R10

29. What are the correct subsequent commands for 1 and 3?

	MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV
(A)	113	DNF	1)1031			
			3)1033			
B	113	DNF	1)1041			
			3)1039			
C	Sec	REFER	1036	REALINE A/P		
D	113	IRd	1)1031			
			3)1033			0970

SITUATION CONTINUED: After the section refires, you in the FDC are working the corrections for the registration.

30. What is the range correction?

(A.) +50

B. -50

C. +100

D. -100

31. What is the range correction factor?

A. -13

(B.) +13

C. +50

D. +12.8

SITUATION CONTINUED: The initial chart deflection was 1010, the final command deflection was 1036.

32. What is the deflection correction?

A. R26

B. 0

C. L26

D. L20

SITUATION CONTINUED: After updating the board and data sheet, the section leader hands you this call for fire and FDC order. He instructs you to compute the mission.

CALL-FOR-FIRE	FDC ORDER
DIO A/F Shift Sec RP1 DIR 2010 R150-200 DN 100 TRUCKS	MORT TO FFE ..... sec MORT TO ADJ ..... METH OF ADJ ..... 1 RG BASIS FOR CORR ..... RP1 SHEAF CORR ..... SHELL & FUZE ..... HE/VT IN ART WP IN MTR METHOD OF FFE ..... 3 RDS RG LATERAL SPREAD ..... ZONE ..... TIME OF OPENING FIRE ..... WHK

33. What is the range correction for V1?

A. -70

B. +20

C. +48

D. -35

34. What is the total range correction (TRC) to apply?

A. +83

B. -35

C. +35

D. +13

35. What is the command deflection for the first round?

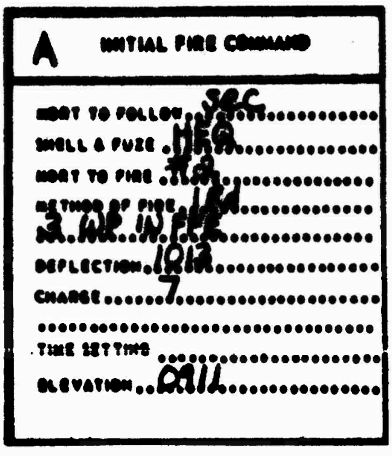
A. 1013

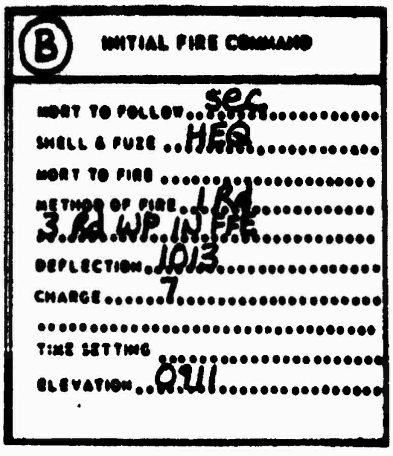
B. 0961

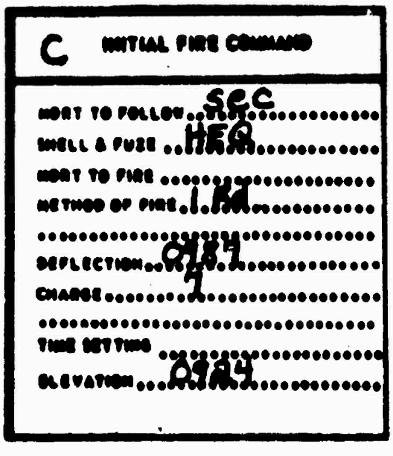
C. 0987

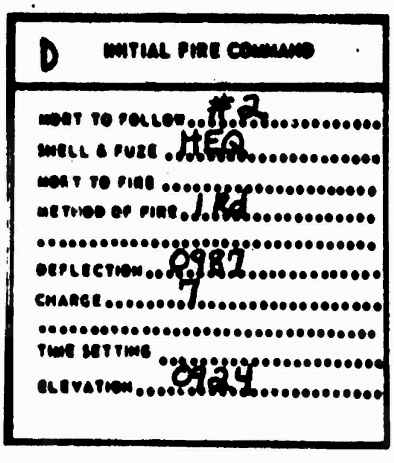
D. 1050

36. What is the correct initial fire command?









The FO spots the round(s) and sends FFE. You fire the rounds, the FO sends EOM, 6 trucks burning. Mark as Tgt DC 10.

SITUATION CONTINUED: During the registration you received this MET message:

MET B 31	MIF MIF
011250	061 987
003110	998 976
013009	029 976
023018	039 974
032805	976 999
043010	020 976
052711	010 987
062904	987 987

You request the platoon sergeant to give you the powder temperature. He tells you 78°. After receiving the information compute the MET message.

37. What is the corrected values for air temperature and air density?

A. 119.5 95.5
B. - .5 -2.1
C. +2.1 + .5
(D.) 102.5 99.7

38. What is the unit correction for air density?

A. -11.8
B. 11.7
(C.) -12.1
D. 11.9

SITUATION CONTINUED: After computing the MET and determining the corrections to be R12 - 6, several hours later you receive another MET. After computing it and determining the correction L31 + 30, you compare and apply the corrections to update your firing data.

39. What is the RCF to apply?

(A.) +22
B. -18
C. +48
D. +30

40. What is the deflection correction to apply?

A. R12
(B.) L69
C. L26
D. L31

APPENDIX E

FDC PROCEDURES II EXAMINATION

INSTRUCTIONS AND ANSWER KEY

1. These are in addition to instructor's orientation.
2. This examination consists of 40 questions.
3. DO NOT WRITE ON OR IN THIS TEST BOOKLET.
4. The following equipment is required for this examination.

   Answer Sheet

   Pencil, #2

   M16 Plotting Board

   Computer's Record, DA 2399

   Data Sheet, DA 2188R

   FT 81-A1-3

   Smoke Table

FDC II EXAMINATION

SITUATION A: Construct a Modified-Observed Firing Chart using the following information:

(1)	Mortar Grid	0219 5725		ALT 500
(2)	Mounting AZ	6100		
(3)	Refered Deflection	3200		
(4)	Grid Intersection	01/59		
(5)	Forward Plot RPI	Chart Deflection	3217	
		Chart Range	3550	
		Alt	450	
(6)	Gun Attitude	1330		(Questions 1 - 4)

SITUATION CONTINUED: After setting up your chart, the section leader hands you the call-for-fire and FDC order below and instructs you to compute the mission using traverse left in the FFE.

CALL-FOR-FIRE	FDC ORDER
A31 A/F SHIFT RP #1 DIR 6200 L150 +100 BUNKERS 400 X 50 ATT 1250 DN 50	MORT TO FFE SEC MORT TO ADJ FO METH OF ADJ IRD BASIS FOR CORR SHEAF CORR SHELL & FUZE HED IN ADJ HED IN FFE METHOD OF FFE RG LATERAL SPREAD ZONE TIME OF OPENING FIRE W/R

1. What is the number of rounds per gun in the FFE?

2. What is the correct initial fire command?

The round is fired and the FO sends these corrections: L50 + 50 FFE.

3. What is the chart deflection and range for the FFE?

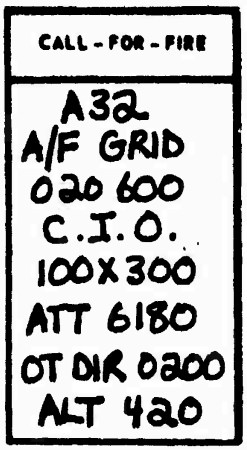
4. What is the correct subsequent commands for the FFE?

The FO sends EOM, 7 bunkers DEST., EST 25% CAS.

NOTE: Mark as target AB 0100

SITUATION CONTINUED: After updating, you receive a call-for-fire and after checking the map, you accept the mission: (Questions 5 - 9)

NOTE: FDC decides to search up.



5. What is the correct FDC order?

6. What is the correct initial fire command?

The FO spots the round and sends these corrections: L600 - 150

7. What is the deflection and elevation to fire the second round?

The FO spots the round and sends this correction: -50 FFE.

SITUATION CONTINUED: The adjusted chart range to center of the area is 2825m.

8. What are the number of turns between rounds?

9. What are the correct fire commands for the FFE?

The rounds are fired and the FO sends, EOM, EST 50% CAS.

NOTE: Mark as target AB 0110

SITUATION CONTINUED: You have been in position for awhile and everyone is getting ready for the night. You receive a call-for-fire and after checking the map, you accept the mission. Using the call-for-fire and FDC order below, compute the mission. (Questions 10 - 12)

Call-for-Fire and FDC Order on next page.

CALL - FOR - FIRE	FDC ORDER
A32 A/F GRID 016 594 SUSPECTED ENEMY ILLUM. OT DIR 6100 TGT ALT 480	MORT TO FFE ..#1.. MORT TO ADJ ..... METH OF ADJ...IRD..... BASIS FOR CORR ..... SHEAF CORR..... SHELL & FUZE ..ILLUM..... ..... METHOD OF FFE..... RG LATERAL SPREAD..... ZONE ..... TIME OF OPENING FIRE ..WIR.....

10. What is the correct heading data?

The first round is fired and the FO sends R200 - 200 D100.

11. What is the correct subsequent command?

The FO sends UP 50.

12. What are the corrections that are applied to base data to get command data?

SITUATION CONTINUED: The FO spots the last round and sends - (Questions 13-17)

CALL - FOR - FIRE
A32 COOR. ILLUM. A/F GRID 016 594 ENEMY VEHICLES WP IN FFE OT DIR 6100 ALT 480

Using this Call-for-Fire

13. What is the correct FDC order?

14. What is the correct initial fire command?

SITUATION CONTINUED: The ILL. Round is fired and the FO tells you ILL. MARK - you stop your watch and note the time to be 60 seconds.

15. What is the time difference to fire the HE round?

The first round of HE is fired and the FO sends: HE - 100

16. What is the chart deflection and range for the HE Round to be fired?

The HE is fired and the FO sends HE R50 - 50 FFE.

17. What is the correct subsequent command for the FFE?

The rounds are fired and the FO sends EOM 6 TRUCKS BURNING.

NOTE: Mark as target AB 0120

SITUATION B: After a night of firing ILL, H&I's, the next morning the platoon leader decides to split the section. He sends #1 gun to grid 0160 5760 and keeps the FDC in the same position.

SITUATION CONTINUED: Shortly after the #1 is in position, the section received a call-for-fire and after checking the map, he accepts the mission and hands you the call-for-fire and FDC order and instructs you to compute the mission. (Questions 18 - 22)

NOTE: #1 gun ALT 450
Referred Deflection 2800

18. What is the mounting azimuth for #1 gun?

Using this Call-for-Fire and FDC order, compute the mission.

CALL-FOR-FIRE	FDC ORDER
A63 A/F GRID 015 609 ENEMY PATROL OT DIR 5900 ALT 500	SEC #1 IRD HE(Q) 3 RD WR

101

19. What is the correct initial fire command?

The FO spots the first round and sends these corrections: R50 - 200 FFE.

20. What is the chart deflection for #2 gun?

21. What is the command elevation for #1 gun?

22. What is the correct subsequent fire command sent to the section?

The FO sends EOM. EST 25% CAS.

NOTE: Mark as target AB 0130

SITUATION C: The Company Commander decides that the Mortar Platoon is to move to its final location, grid 0230 5790. The platoon moves to that position and the platoon leader instructs you to construct a modified-observed firing chart. Using the information below, construct the chart:

(1)	Mortar Grid	0230 5790	400
(2)	Grid Intersection	01/59	
(3)	Referred deflection	2800	
(4)	Mounting AZ	6000	
(5)	Forward plot RP1	Chart deflection	2820
		Chart range	3000
		Alt	450
(6)	Forward plot AB0130	Chart deflection	2630
		Chart range	2925
		Alt	500

SITUATION CONTINUED: After setting up the board, the section sergeant receives -

(Questions 24, 26, 28)

CALL-FOR-FIRE

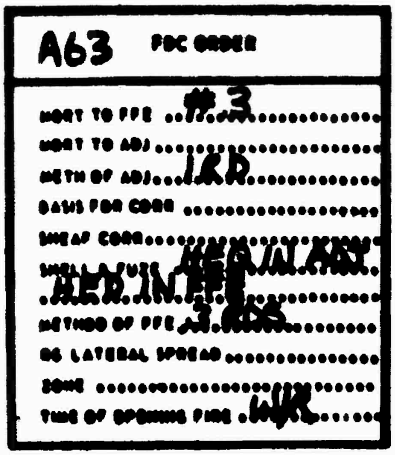
A63
A/F GRID
011 596
ENY OP
w/ COVER
OT DIR 6300
ALT 440

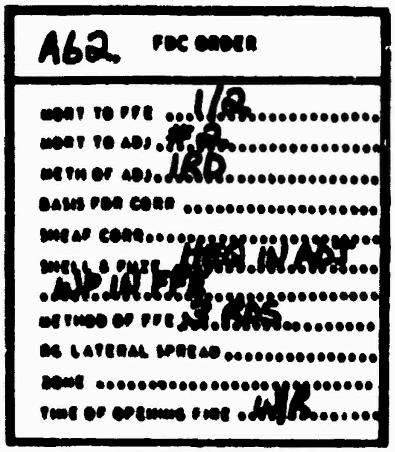
(Questions 23, 25, 27)

CALL-FOR-FIRE

A62
A/F SHIFT
AB 0130
DIR 0200
R75 +100
TRUCKS

After checking the map, the section sergeant accepts the mission and hands you the Call-for-Fire and FDC order.





23. What is the initial fire command for A62's mission?

24. What is the heading data for A63's mission?

The first round is fired and A62 sends FFE.

25. What is the correct chart deflection for the FFE?

A63 spots the first round and sends this correction: -100.

26. What is the correct subsequent command?

27. What is the correct subsequent command for A62's FFE?

A63 spots the second round and sends this correction: -50 FFE.

28. What is the command deflection and elevation for the FFE (A63)?

A62 and 63 observe the FFE's and send EOM, TARGETS DEST., EST 20% CAS.

NOTE: Mark as targets A62-AB0150, A63-AB0160

SITUATION CONTINUED: After completing the last missions and updating your equipment, the Company Commander calls the platoon leader and tells him to set up an FPF at grid 023591. The platoon leader informs the FO of the Company Commander's request and the FO sends a call-for-fire. The platoon leader issues the FDC order. Using the Call-for-Fire and FDC Order below, compute the mission. (Questions 29 - 32)

CALL-FOR-FIRE	FDC ORDER
A63 A/F SEC GRID 023591 FPF ATT 0750 DIC S/R HED IN ADJ OT DIR 6300 TGT ALT 400	MORT TO FFE SEC MORT TO ADJ METH OF ADJ. IRP S/R BASIS FOR CORR SHEAF CORR SHELL & FUZE HED IN ADJ MED W FFE METHOD OF FFE 20 RDS RG LATERAL SPREAD ZONE TIME OF OPENING FIRE W/R

29. What is the correct initial fire command to fire the first round?

The FO spots the first round and sends these corrections: #3, L25 + 25. The round is fired and the FO sends #3 ADJ REP #2.

30. What is the correct deflection and elevation for #2 gun to fire?

NOTE: The FO spots #2 and sends this correction: R25.

31. What is the elevation to fire the round?

The FO spots the round and sends this correction: +25. The round is fired and the FO sends #2 ADJ REP #1. The round is fired and the FO sends these corrections: R25 + 25.

32. What is the correct deflection and elevation for #1 to fire?

The last round is fired and the FO sends EOM FPF ADJ.

SITUATION CONTINUED: After sending the FPF data to the guns, the section leader receives a Call-for-Fire. After checking the map, he issues the FDC order. You receive the Call-for-Fire and FDC order and are instructed to compute the mission. (Questions 33 - 34)

CALL-FOR-FIRE	FDC ORDER
D61 IMMED SMOKE SHIFT AB0160 DIR 6200 R100	MORT TO FFE SEC MORT TO ADJ METH OF ADJ BASIS FOR CORR SHEAF CORR SHELL & FUZE WP METHOD OF FFE ADJ RC LATERAL SPREAD ZONE TIME OF OPENING FIRE WR

33. What is the initial fire command?

34. What is the total number of rounds for this mission?

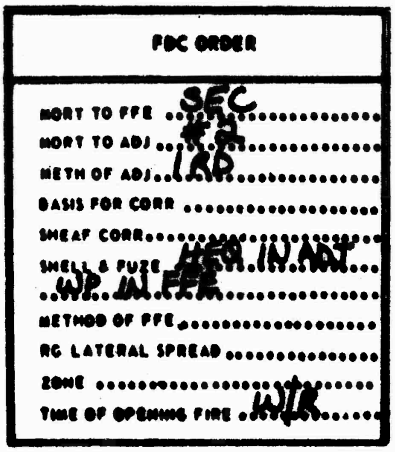
The rounds are fired and FO sends EOM GOOD SCREEN.

SITUATION CONTINUED: The Bn Commander receives word that B Company is getting pressure from the enemy and orders the Mortar Platoon to fire a quick smoke mission so that B Company can move to another position. He wants the smoke for 10 minutes. The FO sends: (Questions 35 - 40)

CALL-FOR-FIRE
L30 AIF GRID 015 605 SCREEN OPEN AREA 300M WIDE CROSSWIND DUR 10 MIN OT DIR 0210 ALT 450

The Section Leader issues the FDC order and instructs you to compute the mission.

NOTE: After checking with the S-2 for the weather conditions, the Platoon Leader gives you this information: Relative humidity 65%
Temp Grad. Lapse
Wind Speed 9 knots
Duration 10 min



35. What is the initial fire command?

The FO spots the first round(s) and sends these corrections: R200 + 100

36. What is the correct subsequent command?

The FO spots the second round and sends these corrections: L50 + 50

37. What is the command def. and elevation?

The round is fired and the FO sends REP WP.

38. What is the correct subsequent command to fire the round?

The FO spots the round and sends FFE. The rounds are fired and the FO sends CONTINUOUS FIRE FROM RIGHT.

39. How many seconds apart should the rounds be fired?

40. What is the total number of rounds for the mission? (WP)

EXAMINATION

FDC PROCEDURES II

ANSWER SHEET

FDC PROCEDURES II EXAMINATION

ANSWER SHEET

NAME _____

SSN _____ DATE _____

1. _____

2.

INITIAL FIRE COMMAND
MORT TO FOLLOW.....
SHELL & FUZE .....
MORT TO FIRE .....
METHOD OF FIRE.....
.....
DEFLECTION.....
CHARGE.....
.....
TIME SETTING .....
ELEVATION.....

3. DEFLECTION _____ RANGE _____

4.

SUBSEQUENT COMMANDS					
MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV

5.

FDC ORDER
MORT TO FFE .....
MORT TO ADJ .....
METH OF ADJ .....
BASIS FOR CORR .....
SHEAF CORR .....
SHELL & FUZE .....
.....
METHOD OF FFE .....
RG LATERAL SPREAD .....
ZONE .....
TIME OF OPENING FIRE .....

6.

INITIAL FIRE COMMAND
MORT TO FOLLOW .....
SHELL & FUZE .....
MORT TO FIRE .....
METHOD OF FIRE .....
.....
DEFLECTION .....
CHARGE .....
.....
TIME SETTING .....
ELEVATION .....

7. DEFLECTION _____ ELEVATION _____

8. _____

9.

SUBSEQUENT COMMANDS					
MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV

10.

VI	CHG RG CORR	CHART DEFL	CHART RG
DEFL CORR		ANGLE T	CHG

11.

SUBSEQUENT COMMANDS					
MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV

12. ELEVATION CORRECTION _____ FUZE SETTING CORRECTION _____

13.

FDC ORDER
MORT TO FFE
MORT TO ADJ
METH OF ADJ
BASIS FOR CORR
SHEAF CORR
SHELL & FUZE
METHOD OF FFE
RG LATERAL SPREAD
ZONE
TIME OF OPENING FIRE

14.

INITIAL FIRE COMMAND
MORT TO FOLLOW
SHELL & FUZE
MORT TO FIRE
METHOD OF FIRE
DEFLECTION
CHARGE
TIME SETTING
ELEVATION

15. _____

16. DEFLECTION _____ RANGE _____

17.

SUBSEQUENT COMMANDS					
MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV

18. _____

19.

INITIAL FIRE COMMAND
MORT TO FOLLOW.....
SHELL & FUZE .....
MORT TO FIRE .....
METHOD OF FIRE.....
.....
DEFLECTION.....
CHARGE.....
.....
TIME SETTING .....
ELEVATION.....

20. _____

21. _____

22.

SUBSEQUENT COMMANDS					
MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV

23.

INITIAL FIRE COMMAND
MORT TO FOLLOW.....
SHELL & FUZE .....
MORT TO FIRE .....
METHOD OF FIRE.....
.....
DEFLECTION.....
CHARGE.....
.....
TIME SETTING .....
ELEVATION.....

24.

VI	CHG RG CORR	CHART DEFL	CHART RG
DEFL CORR		ANGLE T	CHG

25. _____

26.

SUBSEQUENT COMMANDS					
MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV

27.

SUBSEQUENT COMMANDS					
MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV

28. DEFLECTION _____ ELEVATION _____

29.

INITIAL FIRE COMMAND
MORT TO FOLLOW.....
SHELL & FUZE .....
MORT TO FIRE .....
METHOD OF FIRE.....
.....
DEFLECTION.....
CHARGE.....
.....
TIME SETTING .....
ELEVATION.....

30. DEFLECTION _____ ELEVATION _____

31. _____

32. DEFLECTION _____ ELEVATION _____

33.

INITIAL FIRE COMMAND
MORT TO FOLLOW.....
SHELL & FUZE .....
MORT TO FIRE .....
METHOD OF FIRE.....
.....
DEFLECTION.....
CHARGE.....
.....
TIME SETTING .....
ELEVATION.....

34. _____

35.

INITIAL FIRE COMMAND
MORT TO FOLLOW.....
SHELL & FUZE .....
MORT TO FIRE .....
METHOD OF FIRE.....
.....
DEFLECTION.....
CHARGE.....
.....
TIME SETTING .....
ELEVATION.....

36.

SUBSEQUENT COMMANDS					
MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV

37. DEFLECTION _____ ELEVATION _____

38.

SUBSEQUENT COMMANDS					
MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV

39. _____

40. _____

EXAMINATION

FDC PROCEDURES II

ANSWER KEY

EXAMINATION

FDC PROCEDURES II

QUESTION POINT VALUE

QUESTION	VALUE	QUESTION	VALUE
1	1	21	1
2	4	22	5
3	2	23	4
4	4	24	4
5	3	25	1
6	4	26	3
7	2	27	3
8	1	28	2
9	5	29	4
10	2	30	2
11	3	31	1
12	2	32	2
13	3	33	3
14	4	34	1
15	1	35	4
16	2	36	2
17	3	37	2
18	1	38	2
19	4	39	1
20	1	40	1

EXAMINATION

FDC PROCEDURES II

ANSWER SHEET

NAME _____

SSN _____ DATE _____

1. 5

2.

INITIAL FIRE COMMAND

MORT TO FOLLOW ... SEC
SHELL & FUZE ... HEQ
MORT TO FIRE ... #2
METHOD OF FIRE ... IRD
5 RDS, HED IN FFE
DEFLECTION ... 3254
CHARGE ... 7
TIME SETTING ...
ELEVATION ... 0936

3. DEFLECTION 3264 RANGE 3750

4.

SUBSEQUENT COMMANDS					
MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV
Prepare		to Traverse		LEFT	
SEC	5 Rds HED	Traverse LEFT		1 TURN	
		1) 3221			
		2) 3247			
		3) 3272	3700		0896

5.

FDC ORDER	
MORT TO FFE	SEC
MORT TO ADJ	#2
METH OF ADJ	IRD
BASIS FOR CORR	
SHEAF CORR	
SHELL & FUZE	HEQ IN ADJ
	PROX IN FFE
METHOD OF FFE	12 RDS
RG LATERAL SPREAD	
ZONE	
TIME OF OPENING FIRE	WIR

6.

INITIAL FIRE COMMAND	
MORT TO FOLLOW	SEC
SHELL & FUZE	HEQ
MORT TO FIRE	#2
METHOD OF FIRE	IRD
	12 RDS PROX IN FFE
DEFLECTION	2971
CHARGE	5
TIME SETTING	
ELEVATION	0988

7. DEFLECTION 3189 ELEVATION 0934

8. 2

9.

SUBSEQUENT COMMANDS					
MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV
SEC	12 RDS PROX	SEARCH	UP 2	TURNS	
		3190	2925		0812

10.

VI	CHG RG CORR	CHART DEFL	CHART RG
Ø	Ø	3171	2225
DEFL CORR		ANGLE T	CHG
		Ø	6/2250

11.

SUBSEQUENT COMMANDS					
MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV
		3069	2050	27.8	1120

12. ELEVATION CORRECTION 15 FUZE SETTING CORRECTION +.7

13.

FDC ORDER	
MORT TO FFE	2/3
MORT TO ADJ	#2
METH OF ADJ	1 RD
BASIS FOR CORR	
SHEAF CORR	
SHELL & FUZE	HEQ IN ADJ. WP IN FFE
METHOD OF FFE	3 RDS
RG LATERAL SPREAD	
ZONE	
TIME OF OPENING FIRE	AMC

14.

INITIAL FIRE COMMAND	
MORT TO FOLLOW	2/3 — 1
SHELL & FUZE	HEQ
MORT TO FIRE	#2
METHOD OF FIRE	1RD AMC — AMC
	3RD WP IN FFE
DEFLECTION	3171
CHARGE	4
TIME SETTING	
ELEVATION	1015 — 1105

15. 32 SEC

16. DEFLECTION 3170 RANGE 2125

17.

SUBSEQUENT COMMANDS					
MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV
#1	2RD				1105
2/3	3WP	3146			1081

18. 6250

19.

INITIAL FIRE COMMAND	
MORT TO FOLLOW	#1
SHELL & FUZE	HEQ
MORT TO FIRE	
METHOD OF FIRE	1RD
	3RDS PFF
DEFLECTION	2680
CHARGE	6
TIME SETTING	
ELEVATION	0965

20. 3059

21. 0969

22.

SUBSEQUENT COMMANDS					
MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV
SEC	3RD	D 2636			0969
		2/3 3059	7		0968

23.

INITIAL FIRE COMMAND
MORT TO FOLLOW 1/2
SHELL & FUZE ..... HEQ
MORT TO FIRE ..... #2
METHOD OF FIRE 1RD
..... 3RDS WP INFFR
DEFLECTION 2595
CHARGE 4
TIME SETTING .....
ELEVATION 1019

24.

VI	CHG RG CORR	CHART DEFL	CHART RG
+40	Ø	3021	2075
DEFL CORR		ANGLE T	CHG
Ø		520	4

25. 2595

26.

SUBSEQUENT COMMANDS					
MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV
		3051	3		0849

27.

SUBSEQUENT COMMANDS					
MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV
1/2	3 RDS WP				1019

28. DEFLECTION 3067 ELEVATION 0888

29.

INITIAL FIRE COMMAND	
MORT TO FOLLOW	SEC
SHELL & FUZE	HED
MORT TO FIRE	
METHOD OF FIRE	IRA SIR 20 RDS HEQ IN FFE
DEFLECTION	7400
CHARGE	2
TIME SETTING	
ELEVATION	1126

30. DEFLECTION 2426 ELEVATION 1111

31. 1111

32. DEFLECTION 2390 ELEVATION 1080

33.

INITIAL FIRE COMMAND	
MORT TO FOLLOW	SEC
SHELL & FUZE	WP
MORT TO FIRE	
METHOD OF FIRE	2 RDS
DEFLECTION	3017
CHARGE	3
TIME SETTING	
ELEVATION	0941

34. 6 WP

35.

INITIAL FIRE COMMAND	
MORT TO FOLLOW	SEC
SHELL & FUZE	HEQ
MORT TO FIRE	#2
METHOD OF FIRE	1 RD
	#1 1/2 3 RDS WP #3 4 RD WP
DEFLECTION	2702
CHARGE	5
TIME SETTING	
ELEVATION	0963

36.

SUBSEQUENT COMMANDS					
MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV
		2619	2750		0963

37. DEFLECTION 2627 ELEVATION 0918

38.

SUBSEQUENT COMMANDS					
MORT FIRE	METHOD FIRE	DEFL	RG / CHG	TIME SETTING	ELEV
	1 RD WP				0918

39. 12 Sec

40. 61 RDs

APPENDIX F

NOTES TO TRAINERS

Purpose

This instructional package is designed to provide the 11C Fire Direction Center (FDC) computer standardized and comprehensive training in the methods and techniques used for the 81mm mortar. It is concerned primarily with the problems, principles, and procedures of converting calls for fire into proper fire commands that, when applied, will assist in insuring the timely delivery of accurate mortar fires.

Scope

This training package encompasses all aspects of FDC computer training applicable to the 81mm mortar. It incorporates approved training objectives and standards of the United States Army Infantry School (USAIS) which are presented in its resident program of instruction for mortar training. The scope includes:

a. FDC organization and equipment

b. Operation of the M16 Plotting Board

c. Observed firing chart (pivot-point method)

d. Observed firing chart (below pivot-point method)

e. Modified observed firing chart

f. Surveyed firing chart

g. Basic missions

h. Safety diagrams

i. Use of deflection conversion tables

j. Meteorological corrections

k. Special missions

Conduct of Training

The instructional format of this training program has been developed to accommodate units with varying degrees of proficiency and/or available training time. It consists of 44 hours of instruction that begins with the introductory/basic tasks and procedures and then progresses systematically through all firing charts, missions, and procedures. Based on unit requirements, training personnel may elect to use all or only a portion of the lessons presented. In addition, instruction can be presented continuously in its entirety or divided into instructional segments to be presented at different time periods. If required, instruction can be conducted on a task-by-task basis as time permits. While different tasks may be taught at different times, it is recommended that all material pertaining to a single task be presented in one continuous block of instruction, rather than several separate blocks.

Training Materials

a. Required for instruction. All necessary lesson plans, supporting Vu-graphs, chart data, command data, calls for fire, and referred deflections are provided in the training package. Units must provide M16 plotting boards, firing tables, computer records, and data sheets. Solutions for each mission in the lessons are provided for the instructor's use.

b. Reinforcement training. Materials recommended for reinforcement training, but not included as a part of this training package, are outlined in an attached list. Reinforcement training materials include team drills, self-paced workbooks, and study guides that may be requisitioned from the USAIS Training and Audiovisual Support Center (TASC). In addition, Training Extension Course (TEC) lessons for all 81mm mortar FDC tasks and procedures are available at installation individual learning centers.

Evaluation of Standards

A total of two examinations are included in this training package to assist in evaluating student performance. These examinations are scheduled to coincide with increases in the degree of difficulty of the instruction. The first examination is to be administered following completion of FDC Procedures I and the second examination following FDC Procedures II. The examinations are situationally oriented and require the student to demonstrate his ability to perform all computer tasks for all missions.

Reinforcement Training Materials

Title	Number	Date
81mm Mortar	FM 23-90	FEB 72
Mortar Gunnery	FM 23-91	DEC 71
Firing Table	FT 81-AI3	MAR 73
M16 Plotting Board	TM 9-1220-204-14	JUN 71
81mm Mortar Instructional Pamphlet	ST 23-90-4	FY83
Fire Direction Center Math Programmed Text	ST 23-91-290	FY76
M16 Plotting Board Programmed Text	E-186-6	SEP 71
81mm Mortar Fire Direction Center Workbook	E-166-1	FY76
FDC Reference Notes M16 Plotting Board (Basic Procedures)	WMID-66 WMID-67	APR 79 FEB 80
Procedures for Computing Special Missions - 81mm Mortar	WMID-67	FEB 80
Observed Chart Team Drill 1	WMID-66	FEB 80
Observed Chart Solution Sheet	WMID-66	FEB 80
Modified Observed Chart Team Drill 2	WMID-66	FEB 80
Modified Observed Chart Solution Sheet 2	WMID-66	FEB 80
Observed/Modified/Surveyed Chart - Team Drill 3	WMID-66	FEB 80
Observed/Modified/Surveyed Chart - Solution Sheet 2	WMID-66	FEB 80
Special Missions - Team Drill 4	WMID-67	FEB 80
Special Missions Solution Sheet	WMID-67	FEB 80
Special Mission - Team Drill 5	WMID-67	FEB 80
Special Mission Solution	WMID-67	FEB 80
FDC Forms	WMID	DEC 78
Smoke & Ammunition Requirements for 4.2 Mortars	FBC 568	APR 70
81 MET Study Guide (DA Forms 3675 & 2601-1)	84926/8880 (1 sheet - 11" x 14")	-

Training Extension Course (TEC) Lessons

Number	Title
010-071-6601-F	FDC-An Introduction (Revised)
010-071-6602-F	FDC-Basic Plotting Techniques, Pt I (Revised)
010-071-6603-F	FDC-Basic Plotting Techniques, Pt II (Revised)
010-071-6604-F	FDC-Basic Plotting Techniques, Pt III
010-071-6605-F	FDC-Basic Plotting Techniques, Pt IV (Revised)
010-071-6606-F	FDC-Formulating Fire Commands (Revised)
010-071-6607-F	FDC-Basic Plotting Tech Skill Practice (Revised)
010-071-6608-F	FDC-Completing the Computer's Record, Pt I
010-071-6609-F	FDC-Completing the Computer's Record, Pt II (Revised)
010-071-6610-F	FDC-Completing the Computer's Record, Pt III
010-071-6611-F	FDC-Completing the Data Sheet
010-071-6612-F	FDC-Registration Missions, Pt I
010-071-6613-F	FDC-Registration Missions, Pt II
010-071-6614-F	FDC-Final Protective Fire Missions
010-071-6615-F	FDC-Target of Opportunity Missions, Pt I
010-071-6616-F	FDC-Target of Opportunity Missions, Pt II
010-071-6618-F	FDC-Coord Illumination Missions, Pt I
010-071-6619-F	FDC-Coord Illumination Missions, Pt II
010-071-6620-F	Surveyed Firing Chart: Corrections, Pt I
010-071-6621-F	Surveyed Firing Chart: Corrections, Pt II
010-071-6622-F	Surveyed Firing Chart: Registration Mission, Pt I
010-071-6623-F	Surveyed Firing Chart: Registration Mission, Pt II
010-071-6624-F	Surveyed Firing Chart: Target of Opportunity Missions
010-071-6625-F	Surveyed Firing Chart: Re-Registration Mission
010-071-6656-A	FDC-Math Programmed Text